(2)

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

SHOULD THE DEFENSE FUEL SUPPLY CENTER
TRADE IN
THE FUTURES MARKET?

by

Brion Scott Snyder

December, 1993

Thesis Advisor: Dr. David Lamm
Associate Advisor: Dr. William Gates

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE 28Dec93	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE SHOULD THE DEFENSE FUEL SUPPLY CENTER TRADE IN THE FUTURES MARKET?	5. FUNDING NUMBERS
6. AUTHOR(S) Brion Scott Snyder	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE *A

13 ABSTRACT *(maximum 200 words)*

The Defense Fuel Supply Center is the primary buying agent for most of the petroleum used by the Department of Defense and other Government agencies. Purchasing nearly 200 million barrels of oil per year, the Fuel Center's costs have varied dramatically depending upon the market price of oil. One creative idea for stabilizing costs and reducing price risk exposure is t hedge purchases in the cash market with the use of futures contracts.

This thesis examines and assesses the ramifications of futures trading in light of current procurement practices, market conditions, and trends, in an effort to answer the question of whether this proposed strategy is viable or wise.

14. SUBJECT TERMS Futures Markets, Hedging, Risk Management, Fuel Prices, Petroleum, Speculation, Utility Analysis, Oil Markets, Fundamental Analysis, Technical Analysis, Financial Management, Contract Managemant, Reinventing Government.	15. NUMBER OF PAGES 264
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18

Approved for public release; distribution is unlimited.

Should the Defense Fuel Supply Center
Trade in the Futures Market?

by

Brion Scott Snyder
Lieutenant, United States Navy
B.S., Penn State University

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1993

Author: Brion Scott Snyder
Brion Scott Snyder

Approved by: David V. Lamm
Dr. David Lamm, Thesis Advisor

William Gates
Dr. William Gates, Associate Advisor

Prof. David Whipple, Chairman
Department of Administrative Sciences

ABSTRACT

The Defense Fuel Supply Center is the primary buying agent for most of the petroleum used by the Department of Defense and other Government agencies. Purchasing nearly 200 million barrels of oil per year, the Fuel Center's costs have varied dramatically depending upon the market price of oil. One creative idea for stabilizing costs and reducing price risk exposure is to hedge purchases in the cash market with the use of futures contracts.

This thesis examines and assesses the ramifications of futures trading in light of current procurement practices, market conditions, and trends, in an effort to answer the question of whether this proposed strategy is viable or wise.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENT

I would like to take this opportunity to thank the many people who made this thesis possible. First, to General Bliss, thank you for this marvelous topic. Your enthusiastic presentation in Monterey inspired my curiosity. To Captain Carpenter at the Defense Fuel Supply Center (DFSC), thank you for your support, particularly for steering me to knowledgeable people and that fantastic Texas chili. To Chris Lee and the many folks in the Office of Market Research, thank you for your technical assistance and the many hours you devoted to helping me understand DFSC's various strategies. To Colonel Dacey and Bernie Duval, thank you for your stimulating perspectives and interest.

To Bob Speir at the Department of Energy, thank you for your assistance, and good luck with your report to Congress. I hope this thesis can help. To Barry Schacter at the Commodity Futures Trading Commission (CFTC), thank you for your insightful comments and explanation of the futures market controls.

To Mark Seetin of the New York Mercantile Exchange (NYMEX), thank you for your marvelous behind-the-scene political perspectives, and your wonderful international stories. From farming to world trade, you are an amazing man. Thank you to Bernie Purta for telling me what really happened the day the World Trade Center was bombed. You too have amazing insight.

A special thank you to Richard Seide, for the many hours you spent helping me to understand NYMEX and the futures market. The quality of your help was simply fantastic. Thank you as well for the unbelievable experience of the trade floor. For an old finance major from Penn State, it truly was a dream come true. Good luck with your new marriage.

A very special thank you to Dr. David Lamm at the Naval Postgraduate School. You have been a mentor to me in so many ways, I can't begin to count them. Thank you for your trust and faith in my abilities. You have opened new doors for me and I can't thank you enough. You sir, are truly an inspiration. If I made you proud, it was only through your guidance and never failing support. Thank you again. Please save me a teaching spot in Monterey.

Thank you as well to Dr. William Gates, for helping me to better understand some of the difficult economic issues, and for your tireless "word-smithing." You have an uncanny ability to say things so much simpler than I. Thank you to Dr. Nancy Roberts. Your discussion of the Bryson Model really gave me the tool I needed to better understand the importance of a strategic framework and context for decision making. Thank you to Alice, my thesis reader, for helping me to graduate. Happy New Year.

Thank you to beautiful Monterey and the State of California. You helped me to keep my sanity. I'll be back.

Finally, a very dear thank you to my wife Teri who put up with my writing antics for more months than I care to admit. For her constant love, support, good humor, and contagious enthusiasm, I feel eternally blessed. As she is about to start a thesis of her own, I dedicate this effort and all of my love and support to her. Dear Teri, it's your turn in the thesis hole. Good luck, with love.

I. INTRODUCTION

A. CHAPTER OVERVIEW

This chapter provides basic background and identifies the primary thesis objectives. It also presents the research questions that will become the primary focus of this research effort. This chapter defines the scope, limitations, and assumptions that have been used to develop this thesis, and also explains the research methodology. Finally, this chapter briefly describes how the thesis is organized and what is addressed in each of the following chapters and appendices.

B. BACKGROUND

The Defense Fuel Supply Center (DFSC) is the primary purchasing agent for most of the fuel requirements within the Department of Defense (DoD) and other Government agencies (DFSC, 1992, pp. 1-33). In this strategically important role, DFSC has grown to become the single largest customer of petroleum in the world (Hart, 1990, p. 34).

While DFSC is the single largest customer, it has procurement handicaps that prevent it from buying oil effectively and efficiently in a world of unpredictable prices. These handicaps reduce flexibility, and add enormous expense to the price that the Government must pay for the petroleum it needs.

The amount of fuel purchased over the past few years has been steadily declining. Despite this fact, DFSC's costs have continually varied between one and ten billion dollars per year, with costs depending heavily on the market price of oil (DFSC, 1992, p. 9).

Since this tremendous market price exposure is not adequately addressed by current contracting methods, an examination of alternative approaches is worthwhile. One creative idea is to allow DFSC to trade in the futures market.

C. OBJECTIVES

This thesis simply seeks to answer the question of whether should DFSC should trade in the futures market. The goal is to discover whether such a commercially based strategy designed to reduce unpredictable price exposure, is viable or even wise for DFSC given its environment. This thesis concludes that it is.

In order to adequately answer this question, this thesis first examines DFSC. It explains DFSC's organization and identifies some of the weaknesses of current procurement practices in light of market conditions, and economic as well as political trends. It then examines the structure and function of the futures market to explain how it operates. The thesis then examines the factors that drive the underlying prices of oil in order to explain their importance and linkage to the futures market. It looks at ways of assessing futures performance, in an attempt to develop feasible futures trading strategies. Finally, it examines futures trading in terms of its strategic fit to determine if a futures trading strategy is plausible.

D. RESEARCH QUESTIONS

The following research questions provide the primary focus of this thesis:

1. Primary Research Question

- Should the Defense Fuel Supply Center trade in the futures market?

2. Subsidiary Research Questions

- What are the potential benefits of the Defense Fuel Supply Center trading in the futures market?
- What are the potential problems of the Defense Fuel Supply Center trading in the futures market?
- What contracting practices or changes would be required to implement a futures trading strategy?
- What are the price drivers in futures contracts and how do they compare with the underlying commodity spot market?
- What are potential ways of measuring futures trading performance?
- Does futures trading have a strategic fit within the Defense Fuel Supply Center?

E. SCOPE, LIMITATIONS, AND ASSUMPTIONS

The primary and specific focus of this thesis is to evaluate whether futures trading is viable or wise for DFSC. However, this thesis also addresses the driving factors which DoD officials should consider in assessing the opportunities, and limitations of applying this widely used commercial practice to a public sector environment.

Although other alternative strategies will be mentioned, this thesis will not evaluate the merits or problems of any other strategy under consideration. This thesis will only seek to provide depth of understanding in futures trading and associated issues.

The general assumption is made that the reader has little knowledge of DFSC or futures trading beyond what has already been mentioned. The assumption is also made that the reader has at least a basic awareness of general management principles, and Government contracting practices.

F. RESEARCH METHODOLOGY

Research for this thesis was started in September of 1992 and concluded in December of 1993. An extensive review of available literature was conducted on the subjects of general economics, oil price behavior and industry history, Government budget policy trends and forecasts, DoD trends and forecasts, futures and options trading mechanics, market history and theory, risk management, fundamental and technical market analysis, market trends and forecasts, corporate finance, strategic planning, auditing and cost accounting, general business management, Total Quality Management, Government procurement reform, and Federal and State Law.

Over 30 hours of personal interviews were conducted with people from DFSC, the Department of Energy (DOE), the Commodities Futures Trading Commission (CFTC), the New York Mercantile Exchange (NYMEX), Congressional Staff, and the States of New York, Texas, and Massachusetts.

On site interviews were held at DFSC, and the Washington D.C. offices of DOE, CFTC, and NYMEX. Available records and private memoranda from these organizations were closely examined. An on site visit was also made to the New York NYMEX offices and trading floor, located in the lower stories of the recently bombed World Trade Center Building in Lower Manhattan.

Additionally, DFSC and NYMEX provided over 30 floppy diskettes of historical price data in *Lotus 1-2-3* format. This information can be made available for follow on research upon request and with written permission from DFSC and NYMEX.

Finally, a roundtable discussion on possible legislative language to authorize futures trading was held with the graduating Acquisition and Contract Management class of the Naval Postgraduate School in Monterey, CA.

G. ORGANIZATION OF STUDY

The following provides a brief description of the remaining chapters and appendices:

- **II. DEFENSE FUEL SUPPLY CENTER BACKGROUND** - This chapter provides an overview of current DFSC business activities and procurement practices, and describes some of the problems they create. It also explains the range of new procurement strategies under consideration, and offers opportunities for further research.

- **III. EXAMINATION OF THE FUTURES MARKET** - This chapter describes the futures market and explains how it is structured, and regulated. It also explains how it functions, and is used by different segments of the market.

- **IV. FACTORS AFFECTING THE UNDERLYING PRICES OF OIL** - This chapter describes the primary factors that drive prices in both the spot and futures markets. This chapter also explains the primary differences that exist between the two most popular methods of market analysis. It also explains the connection between futures market prices and the spot prices of the underlying oil commodities they represent.

- **V. ASSESSING FUTURES PERFORMANCE** - This chapter looks at potential ways of assessing and measuring futures trading performance. It explains basic trading strategy design, and offers an example of a workable strategy that could be used as a guide for more sophisticated strategy development.

- **VI. ANALYSIS OF STRATEGIC FIT** - This chapter examines futures trading in terms of its strategic fit to the relevant public sector environment. It describes the importance of strategic fit, and uses a public sector based strategic planning model to determine whether futures trading has a particular strategic fit within DFSC. This chapter examines some of the barriers to futures trading and describes what would be required for implementation. This chapter also provides sample legislative language as a guide for developing proposals to authorize futures trading within DoD.

- **VII. CONCLUSIONS AND RECOMMENDATIONS** - This chapter provides a brief review summarizing the intent and general focus of the various topics discussed throughout the thesis. It also offers specific conclusions and recommendations based upon an interpretive assessment of the research completed. Finally, it addresses and answers each of the research questions originally posed, and recommends areas for further research.

- **APPENDIX A - GROUND FUELS DIVISIONS** - This appendix provides statistical business information for two operating divisions within DFSC.

- **APPENDIX B - SPECIALTY FUELS DIVISION** - This appendix provides statistical business information for an operating division within DFSC.

- **APPENDIX C - NATURAL GAS DIVISION** - This appendix provides statistical business information for an operating division within DFSC.

- **APPENDIX D - SPECIALTY ACQUISITIONS DIVISION** - This appendix provides statistical business information for an operating division within DFSC.

- **APPENDIX E - BULK FUELS DIVISION** - This appendix provides statistical business information for an operating division within DFSC.

- **APPENDIX F - GLOSSARY OF TERMS** - This appendix provides a copy of a futures trading glossary developed by the New York Mercantile Exchange and geared toward the general public.

- **APPENDIX G - FUTURES CONTRACT SPECIFICATIONS** - This appendix provides a copy of standardized futures contract specifications for commodities traded on the New York Mercantile Exchange.

- **APPENDIX H - SELECTED PRICE DATA** - This appendix provides selected historical price information that was used to develop sample trading strategies for Chapter V.

H. SUMMARY

This thesis seeks to answer the question of whether DFSC should trade in the futures market. The primary goal is to discover whether this strategy would be viable or wise. The research questions presented will act as the primary focus for the remainder of this thesis, while the chapters described will provide the structure. Additional information, such as business statistics, key terms, contract requirements, and selected data, is provided in the appendices listed.

II. DEFENSE FUEL SUPPLY CENTER BACKGROUND

A. CHAPTER OVERVIEW

This chapter describes the basic context of DFSC's current operations and provides a foundation for further examination. It provides an overview of DFSC's current organizational structure and summarizes many of the major business activities for which DFSC is responsible. Some contextual perspective is given to current procurement practices and some of the problems they create. Reasons are given for looking at new procurement strategies, while the range of new ideas is briefly discussed. Finally, opportunities for further research are identified.

B. ORGANIZATION AND BUSINESS ACTIVITY

1. Primary Role

The Defense Fuel Supply Center is the primary inventory manager and purchasing agent for most of the fuel requirements within the Department of Defense (DoD). Additionally, it provides similar services to many non-DoD activities including the Postal Service, Veterans Administration, General Services Administration, and National Aeronautics and Space Administration. It also services most of the major departments of the Federal Government including the Departments of Agriculture, Commerce, Energy, Interior, Justice, and Transportation. (DFSC, 1992, pp. 1-33)

In this strategically important role, DFSC has grown to become the single largest customer of petroleum in the world. On average it purchases more than half a million barrels[1] of fuel products each day for DoD and other Federal agencies. (Hart, 1990, p. 34)

2. External Chain of Command

Organizationally, DFSC is a subordinate activity of the Defense Logistics Agency (DLA). Figure 1 shows how DFSC fits into DLA's structure. (Defense Logistics Agency Command Support Office, 1993)

Within the broader chain of command, DLA reports directly to the Under Secretary of Defense (Acquisition and Technology), with dotted line relationships to both the Joint Chiefs of Staff and the Acquisition Heads of the various Armed Services. It provides both general materiel and contract management support, as well as weapon systems support for all of the Armed Service branches. (Freeman and Gandy, 1989)

Major subunits under DLA include the Offices of Materiel Management, Comptroller, Corporate Administration, General Counsel, and Acquisition. The Office of Acquisition performs a variety of general procurement and contract management services, and is further divided into Defense

[1]One barrel equals 42 gallons.

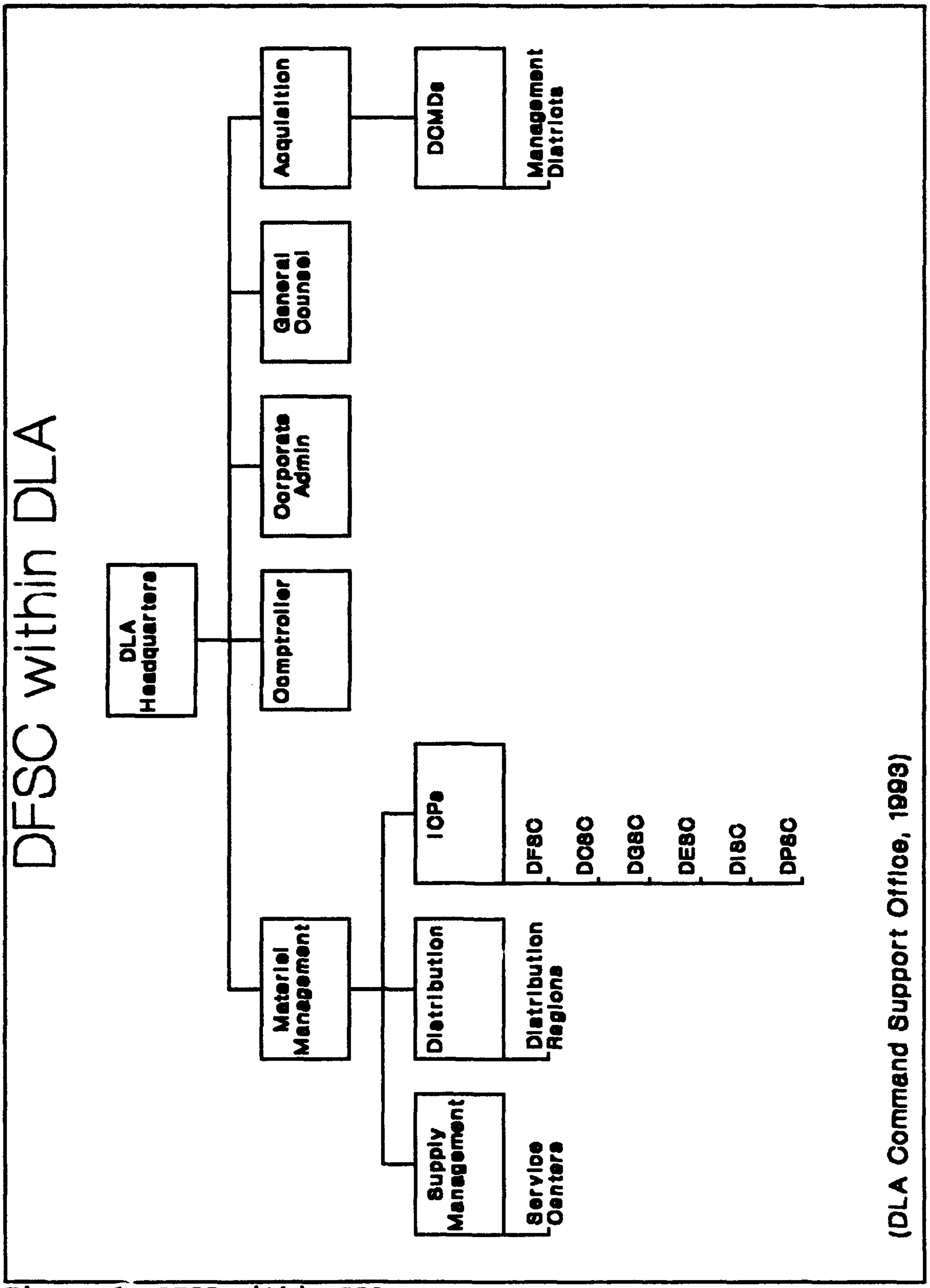


Figure 1 DFSC within DLA

Contract Management Districts (DCMDs). Each DCMD provides contract management support services to a particular geographic region of the United States. (Defense Logistics Agency Command Support Office, 1993)

The Office of Materiel Management coordinates Supply Management, Distribution, and a number of Inventory Control Points (ICPs). The Supply Management function is organized through various Service Centers. These Service Centers include the Defense National Stockpile Center, the Defense Logistics Services Center, and the Defense Reutilization and Marketing Service. The Distribution function is organized through Distribution Regions that geographically manage Eastern and Western zones. The ICPs are organized around broad types of commodities. (Defense Logistics Agency Command Support Office, 1993)

Each ICP is responsible for procuring and managing broad categories of items commonly used by all of the Armed Services as well as numerous Federal and Civil agencies. The Defense Personnel Support Center (DPSC) manages medical materials, clothing, textiles, and subsistence items (Customer Assistance Handbook, 1991, pp. 28-32). The Defense Industrial Supply Center (DISC) manages common hardware items, industrial accessories, and various engine components. The Defense Electronics Supply Center (DESC) manages electrical connectors, semiconductor devices, and electronic components. The Defense General Supply Center (DGSC) manages various machinery, appliances, furnishings, instruments, chemicals, and miscellaneous printed materials. The Defense Construction Supply Center (DCSC) manages excavation equipment, guns, construction materials, diving equipment, and water purification equipment. Finally, the Defense Fuel Supply Center (DFSC) is responsible for managing a full spectrum of energy products including jet fuels, gasolines, gasohol, distillates, residuals, bulk lubricants, coal, crude oil, natural gas, and synthetic fuels. (Department of Defense, pp. 39-40)

3. Internal Organization

Figure 2 illustrates DFSC's internal structure. The Defense Fuel Supply Center has its own Office of Counsel, as well as many other Directorates for specific support functions including Supply Operations, Alternative Fuels, Quality Assurance, Information Systems, Resources Management, Finance and Accounting, and Personal Staff. (Defense Logistics Agency Command Support Office, 1993)

Of particular interest is the Office of Market Research and Analysis. This department employs numerous industry economists, market analysts, and Strategic Petroleum Reserve experts. They provide extensive analytical, theoretical, and practical support, as well as training for both procurement strategy development and program execution. Most of these highly professionalized individuals have

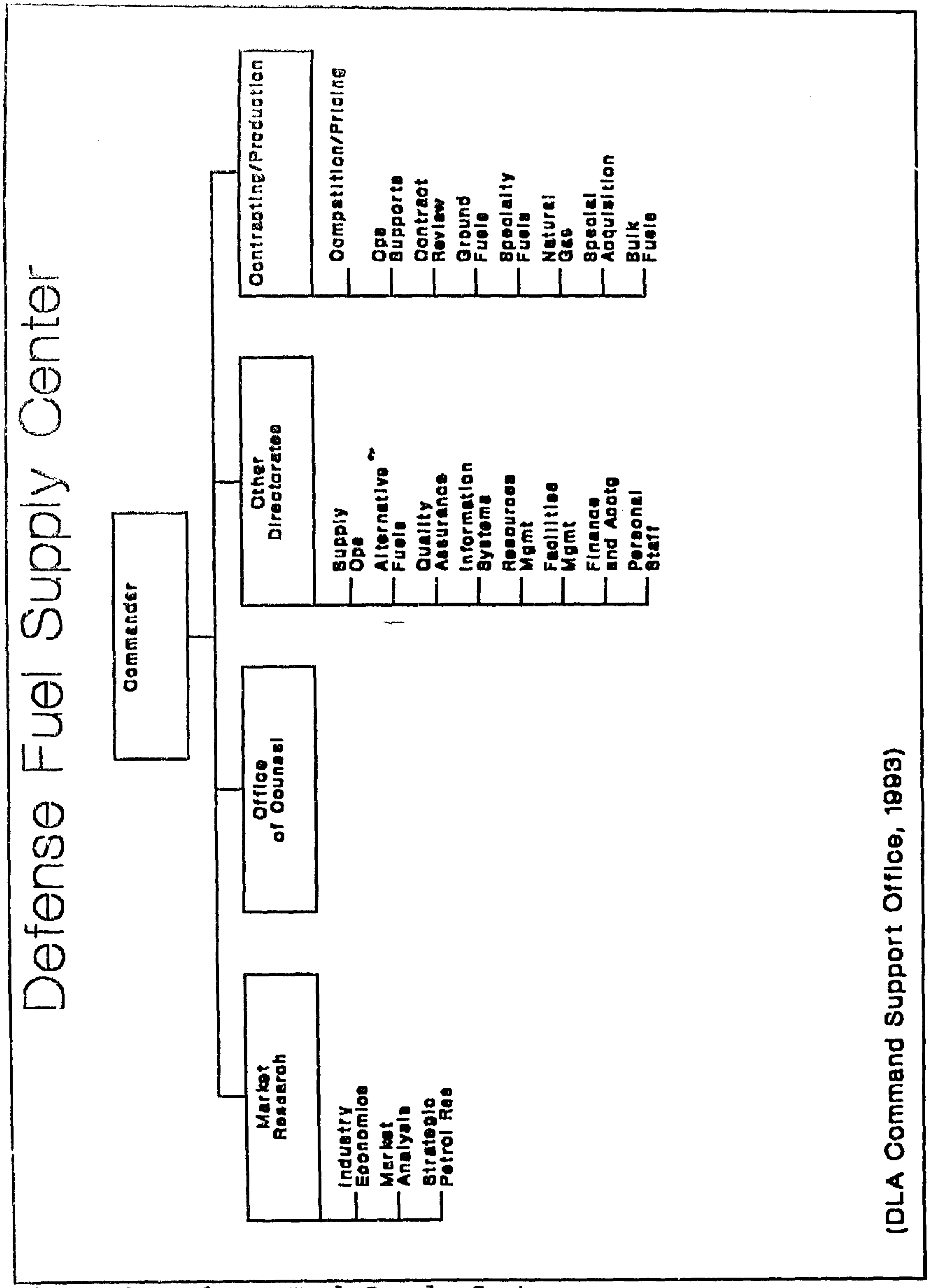


Figure 2 Defense Fuel Supply Center

received extensive training in the field of economic analysis. All possess advanced degrees, while some boast many years of analytical experience. Christopher Lee, the current Department Director, holds a Ph.D. in Economics and has been reputably published in numerous Defense and oil industry journals. In fact, most of the employees in this office have been published in similarly respected journals.[2]

The procurement function resides within the Directorate of Contracting and Production where most of the actual buying occurs. Primarily, this department employs GS-1102 Contract Specialists who receive three years of general DoD procurement training as well as specialized training in petroleum commodity buying. The typical buyer enters DFSC with a four year Bachelors degree and starts work as a GS-5 grade Procurement Trainee. Unfortunately, this office has a high turnover rate. Many of these buyers will transfer or be promoted to other Government Procurement Activities within three or four years after joining DFSC. (DFSC, 1991, p. 23)

The Directorate of Contracting and Production is divided into various support functions and divisions specializing in commodity acquisition. The major support functions include Competition and Pricing, Operations Support, and Contract Review. The actual buying offices include the

---

[2]Interview between C. Lee, Director of Market Research and Analysis, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 23 August 1993.

Divisions of Ground Fuels, Specialty Fuels, Natural Gas, Special Acquisitions, and Bulk Fuels. (Defense Logistics Agency Command Support Office, 1993)

The two Ground Fuels Divisions buy coal and bulk lubricants, as well as fuels specific to Army Posts, Marine Camps, and Naval Stations, for both domestic and overseas use. The Specialty Fuels Division buys domestic and overseas bunker fuels for ships, and into-plane contracts for refueling military aircraft at commercial airports. The Natural Gas Division buys natural gas products for DoD as well other Federal and Civil agencies. The Special Acquisitions Division buys fuels for alongside aircraft refueling at Naval Air Stations, provides small purchase and base contracting support, conducts special studies of commercial activities, and manages petroleum inventories at both Government Owned Contractor Operated (GOCO) and Contractor Owned Contractor Operated (COCO) storage facilities around the world. Finally, the Bulk Fuels Division buys most of the jet fuels, motor gasolines, diesel fuels, and fuel oils used both domestically and overseas by DFSC's customers. (DFSC, 1992, pp. 23-56)

4. Business Activity

Appendices A through E provide more detailed information on the unique business activities of each of the buying divisions mentioned. In terms of general business activity however, jet fuels comprise the largest portion of petroleum products purchased by DFSC. Consisting of naphtha based products like JP-4 and kerosine based products like JP-5 and JP-8, jet fuels make up more than 70 percent of the aggregate volume of petroleum products purchased each year. Distillates make up nearly 25 percent, with aviation gasolines (AVGAS), motor gasolines, and heavy residuals making up the balance. (DFSC, 1992, p. 7-8)

As should be expected with continually shrinking budgets, total purchases have declined in recent years. Volumes of all petroleum based products bought have declined by almost 50 percent in less than ten years. Table I gives a breakdown of total volumes purchased for each of the various petroleum products managed since 1986. (DFSC, 1992, p. 7-8)

TABLE I BARRELS PURCHASED

BARRELS PURCHASED
(in millions)

	1986	**1988**	**1990**	**1992**
AVGAS	.3	.1	.1	.1
Jet Fuel	141.8	146.0	143.9	85.8
Motor Gas	8.6	6.7	4.7	3.0
Distillates	49.6	48.6	43.3	29.3
Residuals	11.6	5.1	5.7	3.8
Totals	212.0	206.5	197.6	121.9

(DFSC, 1992, p. 8)

In terms of actual sources of supply, there is a distinctively American preference. In fact, nearly 85 percent of the petroleum purchased comes from domestic and Canadian sources. Astonishingly, less than two percent of all of the petroleum bought by DFSC comes from the Middle East or Latin America. (DFSC, 1992, pp. 4-12)

Although small business plays an important role in DFSC's activities through various set-aside programs, roughly 70 percent of the contract dollars go to well known major companies. As shown by Table II, more than 50 percent of DFSC's total business is spread between the top ten suppliers. (DFSC, 1992, pp. 15-18)

The Defense Fuel Supply Center is a world-wide buyer and manager of petroleum and other energy related products. This global activity reflects the fact that petroleum is a world-wide industry and DoD, DFSC's primary customer, has a world-wide presence. To capitalize on world price opportunities and global competition, DFSC has developed more than 5,100 sources of supply world-wide, and relies on competitive procurement procedures for nearly 98 percent of its purchases (DFSC, 1992, p. 4-11).

Despite the strengths of this competitive business practice and infrastructure base, DFSC is unable to react quickly to world price opportunities on a routine basis. This becomes a critical factor as Defense budgets decline and world oil prices fluctuate dramatically. Current procurement practices cause most of the problems.

TABLE II TOP TEN DFSC CONTRACTORS IN FY 92

TOP TEN DFSC CONTRACTORS IN FY 92

Rank	Company	Dollar Awards (Millions)	Percent of Total Business
1.	Costal	$ 302.8	8.4%
2.	Exxon	$ 298.7	8.3%
3.	Shell	$ 287.2	8.0%
4.	Arco	$ 226.4	6.3%
5.	Amoco	$ 154.3	4.3%
6.	Mobile	$ 124.6	3.5%
7.	Chevron	$ 124.5	3.5%
8.	Pride	$ 104.5	2.9%
9.	Sun Oil	$ 98.4	2.7%
10.	Phillips	$ 84.7	2.4%
	Totals	$1,806.1	50.3%

Total Worldwide Contract Awards = $ 3,588.6 million

(DFSC, 1992, p. 15)

C. CURRENT PROCUREMENT PRACTICES

1. General Handicaps

While DFSC is the single largest customer of petroleum in the world, its procurement practices prevent it from buying effectively and efficiently in a world of volatile oil prices. These practices not only reduce flexibility, but add avoidable costs to the total price the Government must ultimately pay for its petroleum needs. Many of these practices are both time consuming and difficult to implement, two factors that are not strategically suitable for reacting quickly to transitory price breaking opportunities in the oil markets. Many practices result from the conflicting and diverse requirements mandated by law. In the face of petroleum markets that are totally unstable and unpredictable, DFSC must promote and administer to a wide variety of Government socio-economic programs, ensure responsibility to national security interests, sustain a sound domestic industrial base in a highly competitive world market, and still be held accountable for ensuring sound financial business judgment in program execution (DFSC, 1993).

2. Contract Duration and Type

A typical fuel contract is written for a one or two year period. These contracts are either based upon firm requirements, or are left indefinite as to quantity. In both types of contracts, limitations are placed on the minimum and maximum delivery orders allowable. For indefinite quantity contracts, limitations are also placed on the minimum and maximum quantities that can be contracted. The fuel itself is called forward through delivery orders written against the contract. Deliveries usually occur in equal monthly installments over the life of the contract. Contract prices are established at the time of contract award. However, due to the current price volatility in the petroleum markets, prices are indexed to market indicators and readjusted at the time of delivery. This price adjustment mechanism will be explained in greater detail later. (DFSC, 1991, p. 21)

Because contract prices are indexed, DFSC is unable to take full advantage of its long-term contracting arrangements, and is unable to lock in the most favorable price for the full life of the contract. Instead, DFSC shares the risk of market price fluctuations with its suppliers. While DFSC reaps the benefit of declining prices during down markets, it is fully exposed during periods of rising prices, and must pay the higher adjusted market price as determined on the date of delivery.

3. Acquisition Cycle

The acquisition process at DFSC itself is long and tedious, with the usual Government mandated requirements at each step in the process. As seen in Table III, it generally takes about 180 days to award a contract (DFSC, 1992, p. 21). Lengthy time to award is yet another factor not strategically suitable to market volatility.

This 180 day acquisition cycle also creates an enormous administrative burden owing to the sheer size of the buys. In the Continental United States, bulk purchases are split between only two major programs. The East/Gulf Program generally starts contract negotiations in the fall. While negotiations for the Inland/West Program are offset by six months to ease some of this administrative burden, and to

TABLE III ACQUISITION PROCESS AND TIMEFRAMES

ACQUISITION PROCESS AND TIMEFRAMES	
Day 1:	Receive Purchase Request
Day 15:	Synopsize the Acquisition
Day 30:	Issue the Solicitation
Day 65:	Close / Open the Solicitation
Day 80:	Open Negotiations (not applicable to sealed bid)
Day 110:	Close Negotiations (not applicable to sealed bid)
Day 170:	Finalize Award Evaluations
Day 180:	Award Contract 30 Days Prior to Beginning of Delivery Period

(DFSC, 1991, p. 22)

ensure that at least half of the domestic requirements are always under contract. (Hart, 1989, p. 9)

The time it takes to award a contract, and the enormity of the administrative burden in doing so, is extremely important. Not only does it make it difficult if not impossible under normal circumstances for DFSC to react to market price opportunities, but it also tends to restrict program effectiveness.

4. Socio-Economic Programs

All Government contracts list numerous clauses aimed at promoting a complex array of socio-economic programs required through statute, regulation, and practice. Contracts written by DFSC are no exception. These contracts include clauses for promoting equal opportunity, enforcing provisions of the Buy American Act, ensuring fair labor standards, promoting environmental protection, and many other objectives too numerous to mention. (DFSC Contract Solicitation, 1993, pp. 2-12)

5. Small Business Set-Asides

Of particular importance are the clauses aimed at promoting small business. They greatly diminish flexibility and add to programmatic costs. As required by the Small Business Act,[3] Federal Agencies must set aside a certain level of acquisitions for the exclusive competitive participation of small business. This is normally required for acquisitions with an anticipated dollar value of $25,000 or less. However, set-aside goals may also be extended to larger value acquisitions when the Contracting Officer determines it to be in the best interest of national security, for the purpose of maintaining or mobilizing the Nation's full productive capacity, or for assuring that a fair proportion of Government contracts are placed with small business firms. (Federal Acquisition Regulation, 1989, sec. 19.000-19.502)

Recognizing these issues, DFSC has established small business set-aside goals of between 28.6 and 31 percent for the domestic portion of its business activities. Domestic

[3]15 U.S.C. 631

business makes up about 85 percent of DFSC's total business, and is worth approximately $2.8 billion per year. Small business purchases have been averaging between 28 and 29.9 percent of this domestic pool. From these set-aside figures, 12.8 percent, or almost half, has been specifically awarded to small disadvantaged businesses at a premium over normal cost. Another 3.3 percent has been awarded to women-owned businesses. (DFSC, 1992, p. 17)

It is important to understand the method in which these set-aside goals are established, because they are difficult to administer, add to costs, and further complicate the procurement process. The Small Business Act requires that each agency with contracting authority establish an Office of Small and Disadvantaged Business Utilization (SADBU). Generally, the SADBU reports directly to the Agency Head, and is responsible for establishing program goals and ensuring compliance with the Act. The Heads of Contracting Activities (HCAs) are responsible for effectively implementing "Small Business," "Small Disadvantaged Business," and "Section 8(a)" utilization programs. These HCAs are also responsible for taking all reasonable actions that would increase small business participation within their own contracting processes. (Federal Acquisition Regulation, 1989, sec. 19.201)

For the petroleum refining industry, a "small business" is defined as any firm having fewer than 1,500 employees, with a capacity to process less than 50,000 barrels of any combination of crude oil or other bona fide feedstock per day. Counted capacity includes processing at any leased facilities, or facilities made available to a firm under exchange agreements whereby another party processes the firm's own crude oil or feedstocks. A "small disadvantaged business" is defined as any small business where at least 51 percent of the firm is owned by individuals who are both socially and economically disadvantaged. "Socially disadvantaged" means individuals who have been subject to racial or ethnic prejudice. "Economically disadvantaged" means individuals who are socially disadvantaged and impaired by diminished opportunities to obtain capital and credit as compared with others in the same business who are not socially disadvantaged. By specific mention, Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, and Asian-Indian Americans are all considered to be socially and economically disadvantaged. "Section 8(a)" firms are defined as small disadvantaged businesses that provide goods or services to a Government agency under a specifically defined subcontracting arrangement through the Small Business Administration. (Federal Acquisition Regulation, 1989, sec. 19.000-19.102)

In the Department of Defense, the Director of Small and Disadvantaged Business Utilization is responsible for developing overall DoD small business and small disadvantaged business goals, which are established in close cooperation with the Small Business Administration. Departmental SADBUs within contracting agencies are then responsible for developing and implementing program goals within their respective agencies. (Department of Defense FAR Supplement, 1989, sec. 219.201)

While small business set-aside programs are intended to be socially responsible, they are political in nature and create substantial programmatic cost premiums. These premiums manifest themselves in the form of diminished program flexibility, handicaps to best value, longer bid processing times, greater administrative resource requirements, and increased prices paid as a result of Small Disadvantaged Business awards and participation.

6. Price Adjustment Mechanism

In addition to ineffective long term contracts, long lead times required to award these contracts, and socio-economic goal handicaps, DFSC must also face the biggest challenge of all, a highly volatile and unstable petroleum market.

Prior to 1973, world prices for petroleum products were remarkably stable. In fact, the nominal price of crude oil had remained fairly constant at less than three dollars a barrel for more than 100 years (BP, 1993, p. 12). With stable prices, it made sense to write long-term fixed-price contracts. This is exactly what DFSC did. (Hart, 1989, p. 8)

However, as can be seen by Figure 3, stable oil markets ended in 1973. The catalyst turned out to be the Yom Kippur War that was then raging in the Middle East. Protesting Western support for Israel, the Persian Gulf countries of OPEC (Organization of Petroleum Exporting Countries) staged the now infamous Arab Oil Embargo and crippled the flow of petroleum to Western industrial nations. At the time, Western nations, including the United States, were heavily dependent on Middle East oil. As a result, world oil prices jumped from $2.90 per barrel in September of that year, to $11.65 by year's end. (Yergin, 1991, p. 791)

Since 1973, a host of factors have strongly influenced radical movements in oil market prices. A few of these factors include the 1979 Iranian revolution, the 1980-1988 Iran-Iraq War, the 1989 *Exxon Valdez* oil spill and North Sea oil platform explosion that occurred later that same year, the 1990 invasion of Kuwait, and the 1991 Persian Gulf War. (Yergin, 1991, p. 791)

As a result of this price volatility since 1973, DFSC has not been able to continue buying large volumes of oil using fixed price contracts. Market forces, which continue to this day, have simply rendered these contracts untenable. Although these contracts could lock in a favorable price for the life of the contract, they could also force either party of the contract to accept potentially ruinous losses. Instead, DFSC now writes contracts using economic price

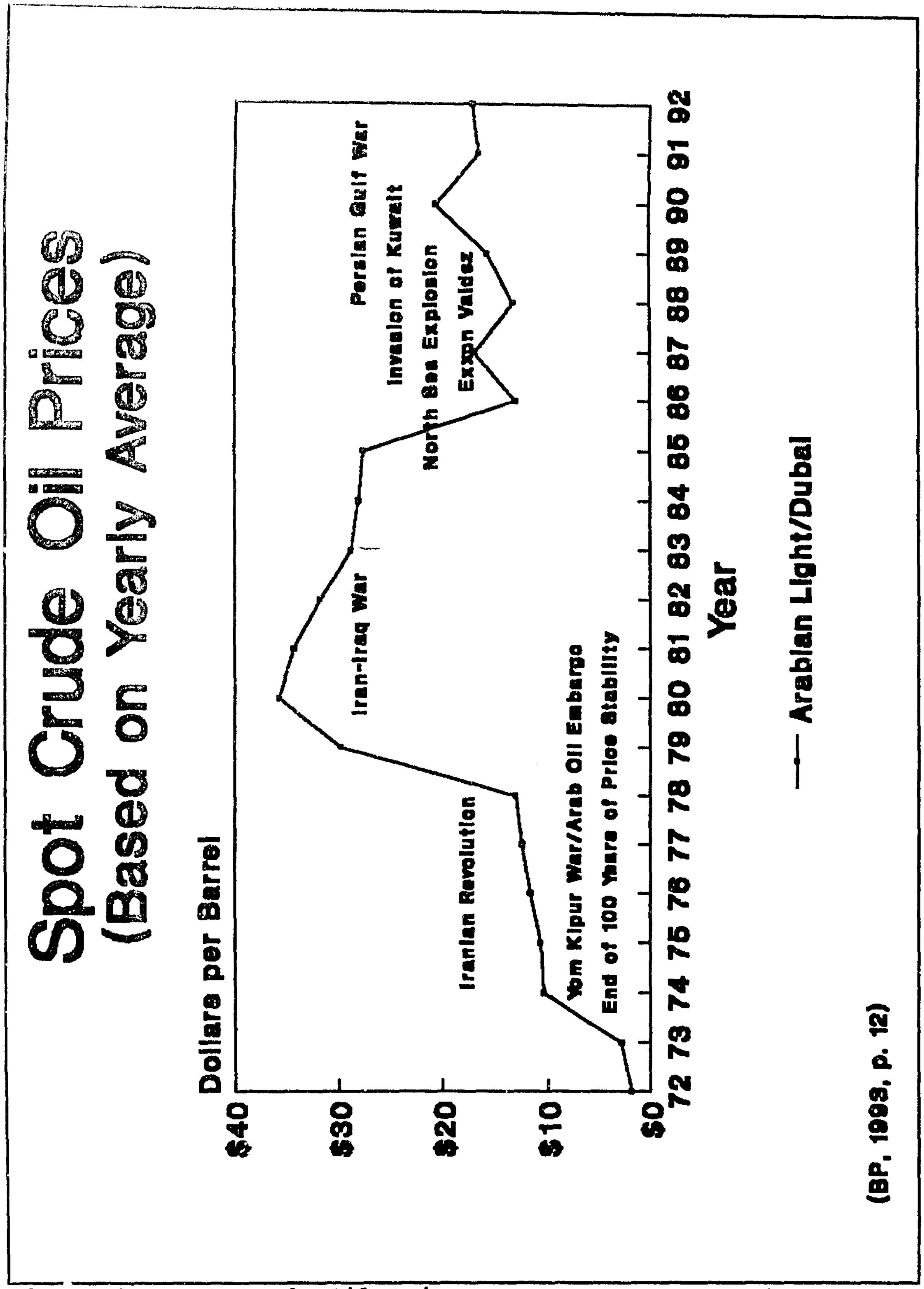


Figure 3 Spot Crude Oil Prices

adjustment mechanisms that are tied to various market indexes. (Hart, 1989, pp. 8-9)

These economic price adjustments provide for both upward and downward revisions to a stated contract price. Adjustments are contingent upon the occurrence of particular events like severe inflation or market price instability. Their use is normally limited by law, but they may be used whenever there is serious doubt that market conditions will be stable during the period of contract performance. The Contracting Officer must determine whether inclusion of price adjustments in a contract is necessary to protect the Government and the contractor from significant risk due to potential fluctuations in labor or material costs. If considered necessary, the Contracting Officer must choose an adjustment mechanism that is limited to contingencies beyond the contractor's control. (Federal Acquisition Regulation, 1989, sec. 16.203)

The Federal Acquisition Regulation allows for three basic types of economic price adjustments. Economic adjustments may be authorized based upon changes in published or otherwise established prices, actual costs of labor or materials, or indexes specifically identified in the contract. The use of any particular index is left to the discretion of the negotiated settlement, or may be prescribed by the agency involved, as in sealed bid contracts. (Federal Acquisition Regulation, 1989, sec. 14.407-16.203)

Any price index used must be published and available to all parties involved. For most bulk contracts, DFSC uses monthly commercial price data collected by the Department of Energy and published in the *Petroleum Marketing Monthly*. For small local supply contracts, DFSC uses weekly commercial price information published in industry periodicals like the *Oil Price Information Service*, *Computer Petroleum Corporation*, and *The Lundberg Letter*. These periodicals contain commercial prices for nearly 300 local market areas across the country. (Hart, 1989, pp. 8-9)

For overseas requirements, DFSC relies heavily upon commercial price information derived from the major spot markets. In Europe, commercial information from the Rotterdam and *Mediterranean* spot markets are used. In the Western Pacific and Persian Gulf regions, DFSC uses commercial price data obtained from the Singapore exchange. (Hart, 1990, p. 35)

Contracts are negotiated in relation to the index used. For bulk contracts, a base month is chosen, and the contractor is asked to submit a price proposal effective as of the base month selected. Awards consider a number of factors, but important consideration is given to the lowest "laid down" cost. "Laid down" cost is basically the refiner's price offer in terms of his ability to satisfy the needs of the contract in each of the requirement locations specified. (Hart, 1989, p. 9) After award, the settlement price is adjusted penny for penny in relation to movements in the index (Hart, 1990, p. 35).

The majority of what DFSC buys is designed specifically for military use and has no exact commercial equivalent. For this reason, the most similar commercial alternative is generally used as an index base. For example, the Navy jet fuel JP-5 is similar to the commercial product Jet-A used by domestic air carriers. As the closest commercial alternative, Jet-A would be used as the index base for JP-5. In the case of the Air Force jet fuel JP-4, commercial gasoline is currently used as the index base. (Hart, 1989, p. 9-11)

While this price adjustment mechanism allows DFSC and its fuel suppliers to share the risk of price volatility, it does not allow DFSC to lock in advantageous price opportunities. This creates a severe handicap. In fact, the effect of the price adjustment mechanism is to merely expose DFSC to unfavorable, uncontrollable, and unpredictable price increases.

D. NEW PROCUREMENT STRATEGIES UNDER CONSIDERATION

1. Reasons for Examining Change

While DFSC's fuel procurement costs mirror price movements in the market, DFSC sells this fuel to its customers at a fixed annually determined "standard" price that generally includes an estimated margin to cover storage, handling, transportation, and other contingencies (Hart, 1990, p.34). In effect, while DFSC shares a portion of market price risk with its suppliers, DFSC assumes the full burden of this price risk for its customers.

This particular management practice, coupled with the many handicapping procurement practices previously mentioned, creates a tremendous budgetary dilemma, especially since approximately 85 percent of DFSC's operating budget is tied to product procurement costs (Lee, 1992). While DFSC assumes the full burden of market price risk for its customers, current budgetary constraint, forecasting imprecision, and exposure to unpredictable market conditions logically forces DFSC, and ultimately policy makers in Washington D.C., to consider one or a combination of several options:

- seek additional budgetary funding,
- reduce the overall quantity of petroleum purchased to remain within budget,
- charge customers a premium as insurance against market price risk in the form of higher average standard prices,
- or seek new alternatives in the form of more innovative procurement strategies.

The boon years of the Reagan administration also marked some of the most unstable times in the history of the petroleum markets. The average price of oil ballooned from about $12 per barrel to nearly $35 per barrel with dramatic and unpredictable price swings (BP, 1993, p. 12). But during this time, no one was really concerned about reducing the military budget. While the operational tempo of the military remained fairly constant, supplemental appropriations granted to DFSC to cover unpredictable increases in oil prices were fairly common.[4]

However, the ability to seek additional budgetary funding may be coming to an end. Since the fall of the Berlin Wall in 1989, (Yergin, 1991, p. 791) Washington D.C. policy makers have been less than sympathetic to ballooning Defense budgets. Luckily during the Persian Gulf War, Saudi Arabia gave the decision makers a slight reprieve by providing much of the needed and markedly more expensive oil to DFSC free of charge. However, this was an extremely unique situation. Saudi Arabia was deeply concerned about its very survival in the face of Saddam Hussein's invasive presence at its border.[5]

The stark reality of the current political situation is that there is a complete and sweeping paradigm shift in thought. With the end of the Cold War, and the end of the Persian Gulf War, and the election of a new Administration with far different priorities from the past Administration, policy makers in Washington D.C. have focused and redoubled their efforts to dramatically reduce military budgets.

---

[4]Interview between C. Lee, Director of Market Research and Analysis, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 23 August 1993.

[5]Interview between C. Lee, Director of Market Research and Analysis, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 24 August 1993.

Priorities have shifted toward concerns over the national deficit, and toward improving the economy and promoting expensive, albeit long over due, social programs like health care reform.

In the wake of these sweeping changes, Defense Operations and Support functions have taken the greatest immediate budget cuts (Couture, 1992, pp. 15-28), and operational tempo is what drives fuel requirements. As can be seen in Figure 4, the quantity of petroleum purchased declined dramatically from 1973 through 1976, due largely to reduced operational requirements as the Vietnam War came to a close. During the Carter and Reagan Administrations, from 1976 through the end of 1988, petroleum purchases remained fairly constant as operational tempo stabilized. However, since 1989 operational tempo has been driven by budgetary reductions, and purchases have dropped with nearly the same magnitude as had occurred at the close of the Vietnam War.

While the amount of fuel purchased has continually and predictably decreased, the annual cost of procurement has been dramatically unpredictable. It has bounced between one and ten billion dollars per year. (DFSC, 1992, p. 9)

According to Market Research Analyst Jim Hart,

> Even the most sophisticated market analyst could not predict all the various turns the market has taken of late. (Hart, 1989, p. 10)

The bitter conclusion is that reducing the overall quantity of petroleum purchased in an effort to remain within

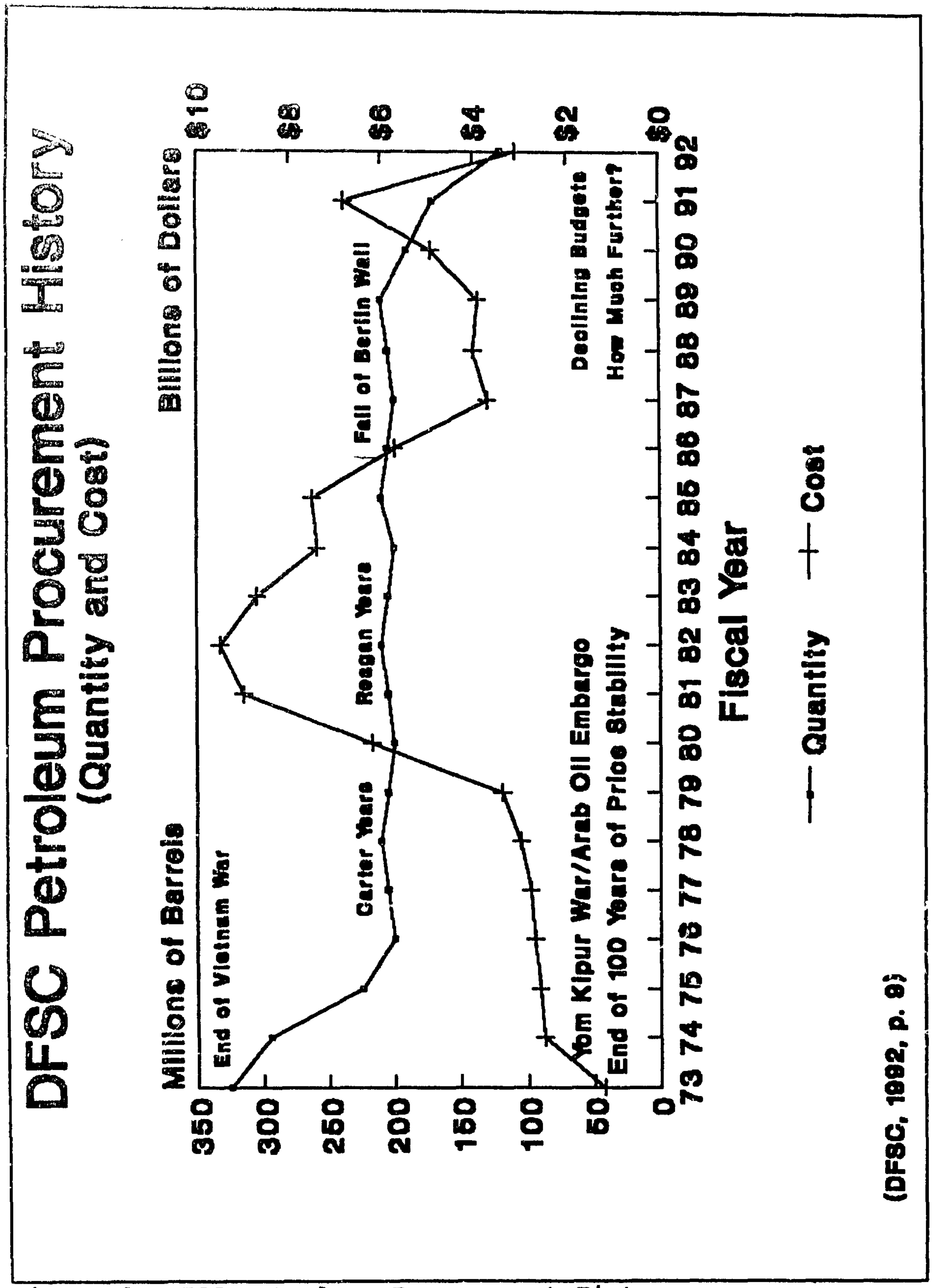


Figure 4 DFSC Petroleum Procurement History

budget would not necessarily work from an economic standpoint, nor would it be something that DFSC could have a great deal of control over. The operational tempo of DFSC's customers is the catalyst that establishes fuel procurement requirements.

Even though operational tempo drives fuel procurement requirements, fuel costs in the form of standard prices impact heavily on operational tempo throughout the military Services, particularly at the field level. There is a keen awareness of this fact at DFSC.[6] While the annual adjustment to standard prices already includes at least some margin or premium to withstand moderate market price volatility,[7] every customer of DFSC faces similar concerns over the budgetary reality of austere times. There is already a vicious cycle of anticipatory actions and reactions to budgetary cuts that adversely impacts on operational tempo. Shifting yet more costs to DFSC's customers would only deepen the problem further.

2. Strategies Worthy of Research

In January of 1992, faced with declining budgets and no apparent solutions to the problems caused by market price volatility, DFSC began to look for new ideas in procurement

[6]Interview between COL R. P. Dacey, Chief of Staff, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 24 August 1993.

[7]Interview between L. C. Ervin, Industry Economist, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 24 August 1993.

strategies. Under the visionary leadership of Brigadier General Stephen M. Bliss, DFSC began to reexamine its procurement practices and looked to the commercial sector for fresh approaches to common problems. As a result of these efforts, DFSC began to explore many ideas that could actually take advantage of market price volatility. Unfortunately, all of the momentum on these alternative strategies was lost when General Bliss transferred from DFSC in July of 1993. As such, many questions about the usefulness of each of these new approaches remain largely unanswered and are worthy of further research.[8]

The focus of this paper, as presented in subsequent chapters, is to reexamine one of these new strategies and to answer some of the lingering questions that still remain. Although a thorough examination as to the specific merits and problems of each strategy is well beyond the scope of this paper, a brief description as to the range of ideas that were under consideration at the time of General Bliss' departure is provided below.

a. Seasonal Stock Building and Drawdown

The primary products purchased under DFSC's bulk fuel programs are JP-5, JP-8, and F-76. JP-5 and JP-8 are both jet fuel products while F-76 is used for shipboard

[8]Interview between CAPT L. H. Carpenter, Director of Contracting and Production, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 25 August 1993.

propulsion. All three are distillates similar in nature to kerosene or home heating oil. Because these products are so similar to home heating oil, their prices tend to be strongly influenced by seasonal pressures. The idea of this strategy is to build up stocks in these products during the spring and summer months, when they are theoretically cheaper, and then drawdown these stocks during the fall and winter months when they are theoretically more expensive. (Lee, January 1992)

b. Timing of Procurements

This strategy also relates to the distillate products already mentioned. The basis of this strategy is the belief that scheduling major negotiations during the warmer months when distillate markets are weakest, would tend to lower supplier bids. Even though actual deliveries would still be scheduled to occur over the course of a full year or more, the belief is that suppliers would be more heavily influenced during negotiations by a tighter current market at the time of negotiations. If DFSC can lock in a lower contractor bid with respect to the price adjustment index used, it would lower the average price paid over the full life of the contract. Even though the price paid would still be tied to fluctuations in the market index, the price differential established during negotiations would constantly remain in DFSC's favor. (Lee, January 1992)

c. Term/Spot Procurement Mix

Under this strategy, the quantity of products procured under one and two year contracts would be reduced to about 65 percent of the total required. The balance of requirements would be bought using spot tenders, or contract offers for immediate delivery, during periods of advantageous market conditions. For example, if market supplies are plentiful and prices are weak, DFSC could take advantage of the situation by buying up to 35 percent of its requirements on a spot basis for immediate delivery. (Lee, January 1992)

d. Lift Scheduling

To "lift" essentially means to accept actual delivery of the petroleum product under contract. The contract price paid is always established at the time of actual delivery or lift, based upon the negotiated price as adjusted by the applicable market index used. Currently, no consideration is given to market price conditions, which drives the market index, in scheduling tanker lifts. During long-term price trends, cargo lift dates could be advanced or postponed to match the direction of the market price movement. Consideration could also be given to arbitrage opportunities. Cheaper cost lifts intended for delivery to one port area could be diverted to higher cost program areas if the price plus transportation savings were advantageous. (Lee, January 1992) *e. Posts, Camps, and Stations Deliveries*

Currently, all of DFSC's customers pay an annually determined standard price for the fuel they receive. Hence, there is little incentive for these customers to alter their ordering habits to conform to favorable market price opportunities. The basis of this idea is that some method could be devised to give major Army Posts, Marine Camps, and Naval Stations an incentive to become aware of market price conditions. Armed with market awareness, these large military bases could advance or delay deliveries to match the direction of the market price movement. (Lee, January 1992)

f. Risk Management

This strategy is the primary focus of this research paper. Basically, DFSC could use the futures market to limit the risk of detrimental price movements affecting its contracts (Lee, January 1992). This is an interesting and creative idea that will be described and evaluated in great detail throughout the remaining chapters.

E. SUMMARY

As an Inventory Control Point under the Defense Logistics Agency, DFSC is organized to buy and manage most of the fuel requirements within the Department of Defense, and other Federal and Civil agencies. While DFSC is the largest single customer for petroleum in the world, many of its procurement practices, some of which are mandated by law, handicap its ability to buy efficiently and effectively in the highly volatile petroleum markets. While market price fluctuations have been a problem since the Arab Oil Embargo of 1973, the political thrust in Washington D.C. since the fall of the Berlin Wall, coupled with declining military budgets, makes exploring new procurement strategies critical. While DFSC began the process of reevaluating its procurement practices in January of 1992, many questions about the potential of new strategies remain largely unanswered and are worthy of further research.

III. EXAMINATION OF THE FUTURES MARKET

A. CHAPTER OVERVIEW

This chapter focuses on the futures market and explains how the market is structured and regulated. This chapter also explains how the futures market functions and is used by the two major segments of the market, hedgers and speculators.

B. STRUCTURE AND REGULATION

Prior to 1983, there was no centralized market for oil commodities trading. For most of its history, the oil industry had been dominated by fully integrated companies which controlled oil all the way from the well head to the gas pump. Thus merchants, brokers, and other intermediaries were relatively unimportant. (Houthakker, 1976, p. 2)

Crude oil was primarily sold under long term contracts between private firms. Contracts were typically multi-year agreements with flexible pricing provisions and renegotiation clauses. Sellers often offered discounts, but usually retained some discretion over the quantities actually delivered. This flexibility allowed sellers to shift supplies to spot market sales when desired. (Horwich, 1984, pp. 197-199)

The spot market, which continues to this day, is not an organized entity. Rather than being a single forum reflecting world activity, like the futures market, the spot market and spot prices reflect only a small portion of world activity in only a few key locations. These locations usually only include major refining and exporting centers like Rotterdam in the Netherlands. Spot prices in these key locations are generally reported by trade publications such as *Petroleum Intelligence Weekly* and *Platt's Oilgram*. During normal market periods, spot prices tend to fluctuate in close proximity to near-term delivery contract prices between large firms. However, during periods of supply disruption, spot prices tend to lead increases in contract prices. Generally, anyone able to buy oil at a stable contract price for the long-term would profit if spot prices increased. (Horwich, 1984, pp. 197-199)

While accounting for only five to fifteen percent of total world activity, the spot market can be a remarkably accurate indicator of long-term price trends. Spot markets have signaled and often precipitated OPEC pricing actions, as well as setting the general tone and movement for oil prices in the mainstream consumer markets. Few if any oil companies sell all of their oil products on the spot market. Rather, most oil companies use the spot market to liquidate surpluses. (Verleger, 1982, pp. 263-265)

1983 marked the first time oil commodities were widely traded in any centralized marketplace. With the introduction of an instrument called West Texas Intermediate (WTI), the New York Mercantile Exchange (NYMEX) became the first organized commodities market to trade in crude oil futures. (Yergin, 1992, 724)

Today there are only three exchanges in the world that trade in oil futures. As shown in Table IV, these are the SIMEX Exchange in Singapore, the IPE Exchange in London, and the NYMEX Exchange in New York. Of these, the NYMEX Exchange in New York is by far the largest, trading nearly 80 percent

TABLE IV EXCHANGES TRADING OIL FUTURES

EXCHANGES TRADING OIL FUTURES

Exchange	Oil Products Traded	1992 Contract Volume Futures	1992 Contract Volume Options
SIMEX Singapore	High Sulfur Fuel	250,455	N/A
IPE, London	Gas Oil	3,144,067	189,709
	Brent Crude	5,528,676	701,894
NYMEX, New York	Heating Oil	7,870,455	1,236,206
	Unleaded Gasoline	6,612,506	857,301
	WTI Crude Oil	20,982,658	6,521,509
	Natural Gas	1,896,689	78,113
	Propane	49,351	N/A

(NYMEX, January 1993, p. 4)

of the total world volume of oil futures contracts. (NYMEX, January 1993, p. 4)

The NYMEX Exchange was founded in 1872 as the Butter and Cheese Exchange of New York, trading almost exclusively in these two agricultural products. In 1882, the name was changed to the New York Mercantile Exchange and other agricultural and foreign currency contracts were added (NYMEX, January 1993). During the 1950s, NYMEX moved toward trading industrial commodities, including platinum and palladium. In 1978, with domestic deregulation in the heating oil market, NYMEX began trading in heating oil futures. While not traded nearly as widely as WTI futures, heating oil futures provided NYMEX with valuable energy commodity experience and was its first energy complex contract. (NYMEX, *Petroleum Marketers Handbook*, Appendix B)

Today, energy related trading accounts for 95 percent of NYMEX's total business, making it the third largest commodities exchange in the world. It is also the only exchange in the world that trades exclusively in strategic industrial commodities. Figure 5 shows the volume of energy contracts traded on the NYMEX Exchange since 1983. Appendix G provides specific information and descriptions of each type of energy contract traded on the NYMEX Exchange. (NYMEX, *Petroleum Marketers Handbook*, Appendix B)

The New York Mercantile Exchange is a nonprofit entity with ownership divided between 816 member seats, held by 750

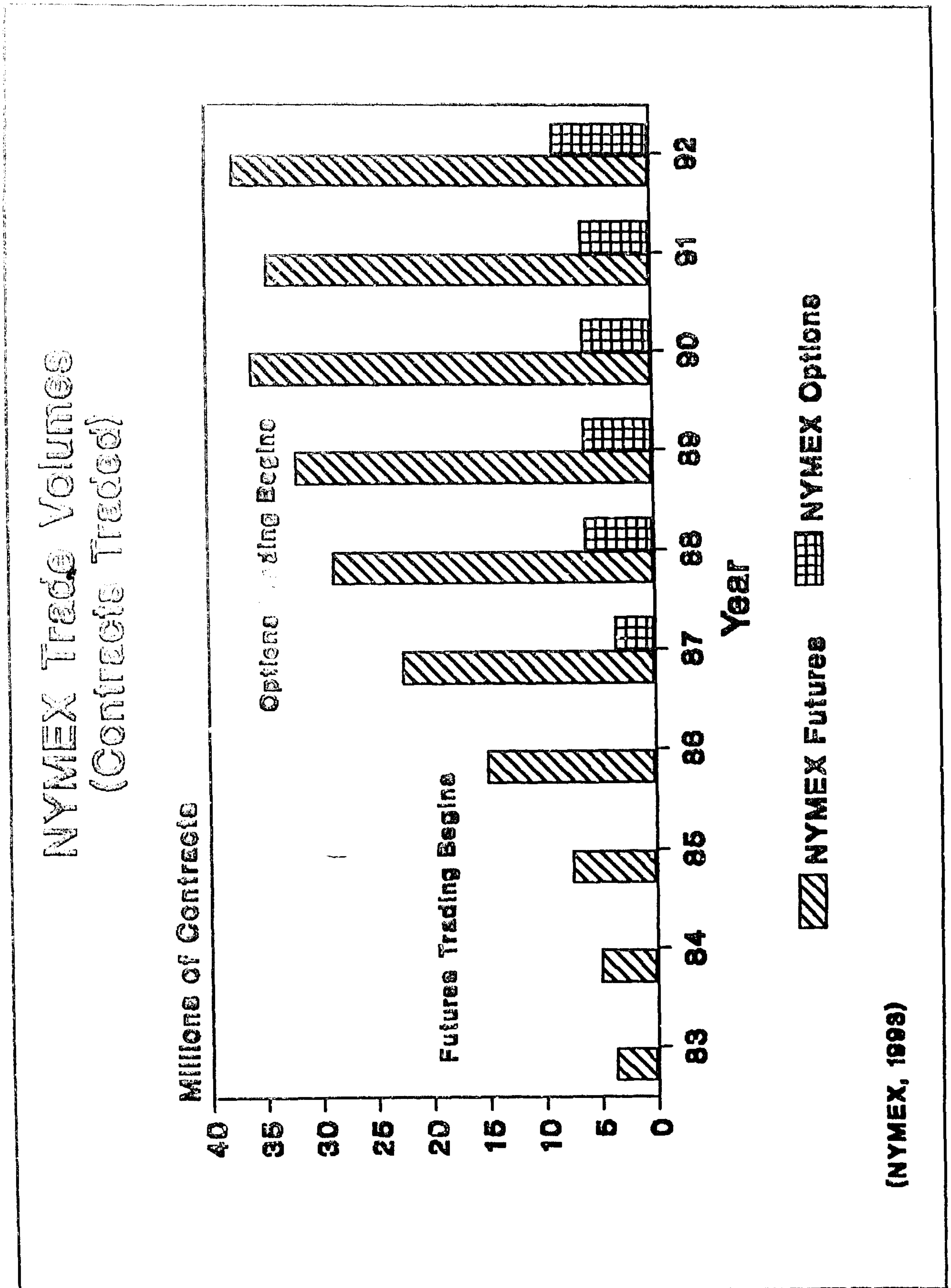


Figure 5 NYMEX Trade Volumes

individuals representing brokerage houses, bankers, professional traders, and businesses with commercial interests in commodities. The NYMEX Exchange itself never actually owns or trades in any of the contracts or commodities it handles. Rather, NYMEX exists as a forum to provide contract standardization, regulation, trade processing, and trading facilities. (NYMEX, *Petroleum Marketers Handbook*, Appendix B)

The NYMEX Exchange, like all commodity exchanges through out the United States, is regulated by the Commodity Futures Trading Commission (CFTC). Established by Congress in 1974, the CFTC is directed by five Commissioners appointed by the President. The CFTC must approve the terms and conditions of all proposed contracts before they can be listed for trading. The CFTC also establishes guidelines for surveillance and reporting requirements, as well as trading restrictions and margin requirements. (NYMEX, 1993)

The NYMEX Exchange is organized to conduct three types of surveillance activities. These include market surveillance, financial surveillance, and trade surveillance. Market surveillance monitors market participants and examines relationships between NYMEX trading activity and fundamental factors affecting underlying commodities. It identifies participants with large reportable positions, an example would be 300 futures contracts for WTI, and ensures compliance with CFTC reporting requirements. It also ensures against price distortion and market manipulation. (NYMEX, March 1993, pp. 2-10)

Financial surveillance audits the financial condition of clearing members and establishes specific capitalization requirements that must be maintained in order to remain a market participant. There are essentially three tiers of market participants, customers, brokers, and clearing members. Customers place their trading instructions with brokers. Brokers execute customer orders on the trading floor. Clearing members act as sponsors to the brokers and ensure the financial integrity of each trade, as well as the entire NYMEX Exchange. Financial surveillance ensures that clearing members maintain adequate financial margins and enforces position limits. Clearing members pass similar restrictions onto brokers and brokers do the same with customers. (NYMEX, March 1993, pp. 2-10)

Clearing members must maintain a minimum working capital of $500,000 on account with a New York City bank that also meets NYMEX Exchange capital and rating requirements. Additionally, clearing members must each contribute capital ranging from $100,000 to $2,000,000 to a NYMEX Exchange guaranty fund for the general protection of the Exchange's financial integrity. (NYMEX, *Petroleum Marketers Handbook*, Appendix B)

Trade surveillance monitors actual trading floor activity. It prevents trading manipulation and anti-competitive activities. It enforces stringent trading and audit recording procedures and uses severe fines and debarment penalties to prevent trade abuses. (NYMEX, March 1993, pp. 2-10)

Specific trading restrictions vary between contract types and trading strategies. Generally, these restrictions break down into price limits, position limits, and margin requirements. Price limits protect the exchange and market participants from dramatic and sudden price movements. If price movement restrictions are exceeded, they automatically suspend trading in a particular commodity for a pre-determined period of time. This cooling off mechanism allows time to assess information on record breaking events. It promotes sensible trading based upon rational thinking and complete information as opposed to irrational panic due to incomplete information.[9]

This mechanism was only required one time in the entire history of the NYMEX Exchange. When Saddam Hussein invaded Kuwait the price of WTI crude oil shot from under $20 per barrel to over $40 in a single afternoon. The threat of panic was so great that then President Bush called the Chairman of the NYMEX Exchange to find out if he intended to shut the Exchange down. By the time the Chairman had received the President's call, trading in WTI futures had already been

[9]Interview between R. Seide, Marketing Manager, New York Mercantile Exchange, New York, NY, and the researcher, 27 August 1993.

suspended for several hours because a $15 price movement limit had been exceeded. After a brief cooling down period, and time to better assess information, trading resumed the same day with only moderate subsequent price movements.[10]

Position limits along with margin requirements ensure that each market participant has the requisite financial capability to sustain unexpected losses. Position limits define the number of outstanding contracts that can be held by any one market participant. Position limits are established based upon the capitalization levels of each firm trading (NYMEX, *Petroleum Marketers Handbook*, Appendix B). Margin requirements establish how much money must be kept on account for each open contract. Margin requirements are based upon a risk assessment of each participant's net market position. Margins on account for each participant are recalculated several times per day and must be readjusted and settled instantly, usually through electronic transfer of funds. (NYMEX, November 1992, pp. 34-35)

In general, there are two types of contracts traded in the futures market, futures and options. A futures contract is a standardized binding obligation to either make or take delivery of a specified quantity and quality of a commodity at a specified location and time in the future. An obligation to

[10]Interview between B. Purta, Vice President Compliance Department, New York Mercantile Exchange, New York, NY, and the researcher, 27 August 1993.

make delivery is called a short position, while and obligation to take delivery is called a long position. An options contract gives the buyer of a futures contract the right but not the obligation to buy or sell the underlying commodity at a fixed "strike" price, over a specified period of time. This right is given by the options writer, or seller, for the payment of a one time premium. An option to buy is called a call, while an option to sell is called a put. (NYMEX, 1993)

Figure 6 is a typical excerpt from the Wall Street Journal. It shows how futures contract trading information is structured. For example, the top entry shows that WTI (Crude Oil, Light Sweet) is traded on the New York Mercantile Exchange (NYM). Each contract represents 1,000 barrels of oil, and prices are listed in dollars per barrel. The entry also shows that futures contracts are currently being traded in the listed months of May 1993 through December 1995. The entry lists opening prices, high, low and settlement ranges, as well as historical highs and lows and current volumes of trade and open contract interests. (NYMEX, April 1993)

Figure 7 shows how similar information for options contracts is structured. For the same crude oil contract previously described, a trader can buy an options call or put for the months of June, July, or August. Strike prices range from $19 to $24 per barrel, with premiums ranging from $.01 to $2.35 per barrel. Trade volumes are listed as well. (NYMEX, April 1993)

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
CRUDE OIL, Light Sweet (NYM) 1,000 bbls.; $ per bbl.								
May	20.43	20.52	20.40	20.46	....	21.59	18.75	54,257
June	20.63	20.73	20.58	20.66	....	22.00	18.63	[illegible]
July	20.73	20.80	20.67	20.74	....	22.58	19.97	29,975
Aug	20.79	20.84	20.72	20.78	– .02	21.22	18.99	24,024
Sept	20.77	20.83	20.74	20.81	– .02	21.10	18.90	26,[illegible]
Oct	20.80	20.81	20.76	20.82	– .02	21.15	19.05	14,340
Nov	20.76	20.79	20.73	20.82	– .02	21.15	19.45	8,428
Dec	20.77	20.83	20.74	20.81	– .02	22.08	18.70	29,032
Ja94	20.79	20.79	20.74	20.78	– .02	21.15	19.38	10,920
Feb	20.77	20.77	20.77	20.75	– .03	20.79	19.20	4,408
Mar	20.75	20.75	20.64	20.72	– .04	21.10	19.14	5,885
Apr	20.68	20.68	20.68	20.70	– .04	20.88	19.30	5,330
May		....	....	20.69	– .01	21.07	19.25	5,357
June		....	....	20.69	– .04	21.35	19.18	9,495
July	20.63	20.63	20.60	20.68	– .05	20.78	19.54	7,879
Aug		....	....	20.68	– .05	20.75	19.42	1,881
Sept	20.62	20.62	20.62	20.67	– .05	20.75	19.31	2,439
Oct		....	....	20.66	– .05	20.48	20.31	607
Dec	20.60	20.60	20.60	20.64	– .05	21.26	19.31	17,163
Mr95		....	....	20.62	– .05	20.55	20.10	388
June	20.60	20.60	20.60	20.61	– .05	21.21	19.20	17,944
Dec		....	....	20.60	– .05	20.80	19.20	9,518
Est vol 63,922; vol Mon 67,889; open int 386,330, +2.								
HEATING OIL NO. 2 (NYM) 42,000 gal.; $ per gal.								
May	.5649	.5670	.5605	.5609	– .0043	.5910	.4950	35,285
June	.5630	.5660	.5605	.5613	– .0024	.5825	.5200	22,912
July	.5665	.5680	.5640	.5641	– .0018	.5920	.5095	15,955
Aug	.5715	.5728	.5695	.5701	– .0013	.5925	.5340	8,493
Sept	.5810	.5818	.5810	.5799	– .0010	.6200	.5440	5,292
Oct	.5810	.5810	.5810	.5884	– .0010	.6000	.5550	4,721
Nov	.5995	.5995	.5995	.5984	– .0008	.6125	.5635	2,709
Dec	.6090	.6090	.6085	.6070	– .0008	.6300	.5725	4,452
Ja94	.6120	.6120	.6120	.6115	– .0008	.6225	.5760	3,577
Feb		....	....	.6095	– .0008	.6180	.5675	884
Mar		....	....	.5968	– .0008	.6030	.5598	1,114
Apr	.5875	.5815	.5815	.5910	– .0008	.5925	.5375	917
May	.5788	.5700	.5700	.5690	– .0008	.5750	.5500	825
June		....	....	.5630	– .0008	.5800	.5300	899
July		....	....	.5635	– .0008	.5710	.5510	1,585
Est vol 19,542; vol Mon 20,489; open int 109,578, –1,284.								
GASOLINE-NY Unleaded (NYM) 42,000 gal.; $ per gal.								
May	.5955	.6030	.5995	.6034	+ .0010	.6485	.5485	50,867
June	.6095	.6130	.6075	.6118	+ .0022	.6440	.5775	26,435
July	.6120	.6145	.6120	.6145	+ .0022	.6375	.5775	11,582
Aug	.6085	.6130	.6085	.6110	+ .0020	.6325	.5730	5,121
Sept	.5970	.5985	.5960	.5982	+ .0015	.6045	.5663	4,551
Oct		....	....	.5822	+ .0015	.5800	.5470	366
Nov		....	....	.5757	+ .0015	.5770	.5470	517
Dec	.5675	.5675	.5660	.5707	+ .0015	.5890	.5280	846
Ja94		....	....	.5677	+ .0015	.5800	.5300	739
Est vol 30,485; vol Mon 13,371; open int 101,380, –11.								
NATURAL GAS (NYM) 10,000 MMBtu.; $ per MMBtu's								
May	2.325	2.450	2.281	2.299	– .004	2.450	1.300	14,100
June	2.258	2.429	2.258	2.305	+ .036	2.469	1.315	13,309
July	2.240	2.400	2.240	2.297	+ .036	2.400	1.190	14,[illegible]
Aug	2.250	2.395	1.250	2.307	+ .044	2.395	1.250	11,779
Sept	2.270	2.415	1.270	2.330	+ .049	2.415	1.470	9,434
Oct	2.320	2.470	2.320	2.383	+ .063	2.470	1.630	5,394
Nov	2.470	2.582	2.450	2.482	+ .057	2.582	1.765	4,989
Dec	2.525	2.680	2.585	2.596	+ .055	2.680	2.000	7,465
Ja94	2.515	2.640	2.515	2.585	+ .059	2.640	1.867	12,823
Feb	2.255	2.400	2.255	2.320	+ .065	2.400	1.800	2,814
Mar	2.125	2.260	2.125	2.185	+ .070	2.260	1.607	3,412
Apr	2.080	2.240	2.080	2.152	+ .062	2.240	1.565	2,853
May	2.085	2.190	2.090	2.160	+ .060	2.190	1.640	1,430
June	2.105	2.190	2.105	2.170	+ .060	2.190	1.580	2,192
July	2.105	2.230	2.105	2.180	+ .060	2.230	1.590	2,017
Aug	2.100	2.270	2.115	2.185	+ .060	2.270	1.715	1,572
Sept	2.120	2.280	2.120	2.189	+ .057	2.280	1.850	1,077
Oct	2.185	2.300	2.185	2.258	+ .080	2.300	1.995	965
Est vol 27,528; vol Mon 17,797; open int 118,976, +676.								

(NYMEX, April 1993)

Figure 6 Wall Street Journal Futures Listing

OIL

CRUDE OIL (NYM)
1,000 bbls.; $ per bbl.

Strike Price	Calls—Settle Jun	Jly	Aug	Puts—Settle Jun	Jly	Aug
19	1.70	1.84	1.94	.04	.11	.17
20	.82	1.01	1.15	.16	.27	.38
21	.23	.41	.58	.57	.67	.80
22	.05	.15	.25	1.39	1.40	....
23	.01	.05	.09	2.25	2.20	....
24	.01	.03	.04	....	....	....

Est. vol. 16,627;
Mon vol. 4,763 calls; 6,636 puts
Op. int. Mon 173,359 calls; 157,917 puts

HEATING OIL No.2 (NYM)
42,000 gal.; $ per gal.

Strike Price	Calls—Settle May	Jun	Jly	Puts—Settle May	Jun	Jly
52	.0411	.0427	.0464	.0002	.0015	.0025
54	.0217	.0257	.0305	.0008	.0045	.0065
56	.0069	.0123	.0181	.0060	.0110	.0140
58	.0015	.0055	.0090	.0206	.0241	.0248
60	.0003	.0022	.0050	.0384	.0409	.0407
62	.0001	.0019	.0025	....	....	....

Est. vol. 1,738;
Mon vol. 423 calls; 620 puts
Op. int. Mon 22,403 calls; 19,363 puts

GASOLINE—Unlead (NYM)
42,000 gal.; $ per gal.

Strike Price	Calls—Settle May	Jun	Jly	Puts—Settle May	Jun	Jly
56	.0437	.0531	.0565	.0003	.0015	.0020
58	.0245	.0357	.0393	.0011	.0040	.0050
60	.0092	.0213	.0259	.0058	.0095	.0115
62	.0017	.0107	.0150	.0183	.0189	.0225
64	.0003	.0053	.0083	....	....	....
66	.0002	.0023	.0043	.0586	....	....

Est. vol. 2,482;
Mon vol. 1,373 calls; 1,812 puts
Op. int. Mon 37,346 calls; 25,097 puts

NATURAL GAS (NYM)
10,000 MMBtu.; $ per MMBtu.

Strike Price	Calls—Settle Jun	Jly	Aug	Puts—Settle Jun	Jly	Aug
220	.160	.175	.190	.055	.085	.087
225	.128	.130	.140	.073	....	.107
230	.095	....	....	.095	....	.131
235	....	.078	....	....	....	.159
240	.085	....	....	....	....	....
245	.043	....	....	....	....	....

Est. vol. 1,509;
Mon vol. 302 calls; 703 puts
Op. int. Mon 11,277 calls; 11,946 puts

BRENT CRUDE (IPE)
1,000 net bbls.; $ per bbl.

Strike Price	Calls—Settle May	Jun	Jly	Puts—Settle May	Jun	Jly
1800	1.14	1.20	1.32	0.09	0.17	0.26
1850	0.71	0.83	0.97	0.16	0.30	0.41
1900	0.37	0.53	0.67	0.32	0.50	0.61
1950	0.14	0.32	0.45	0.59	0.79	0.89
2000	0.06	0.17	0.29	1.01	1.14	1.23

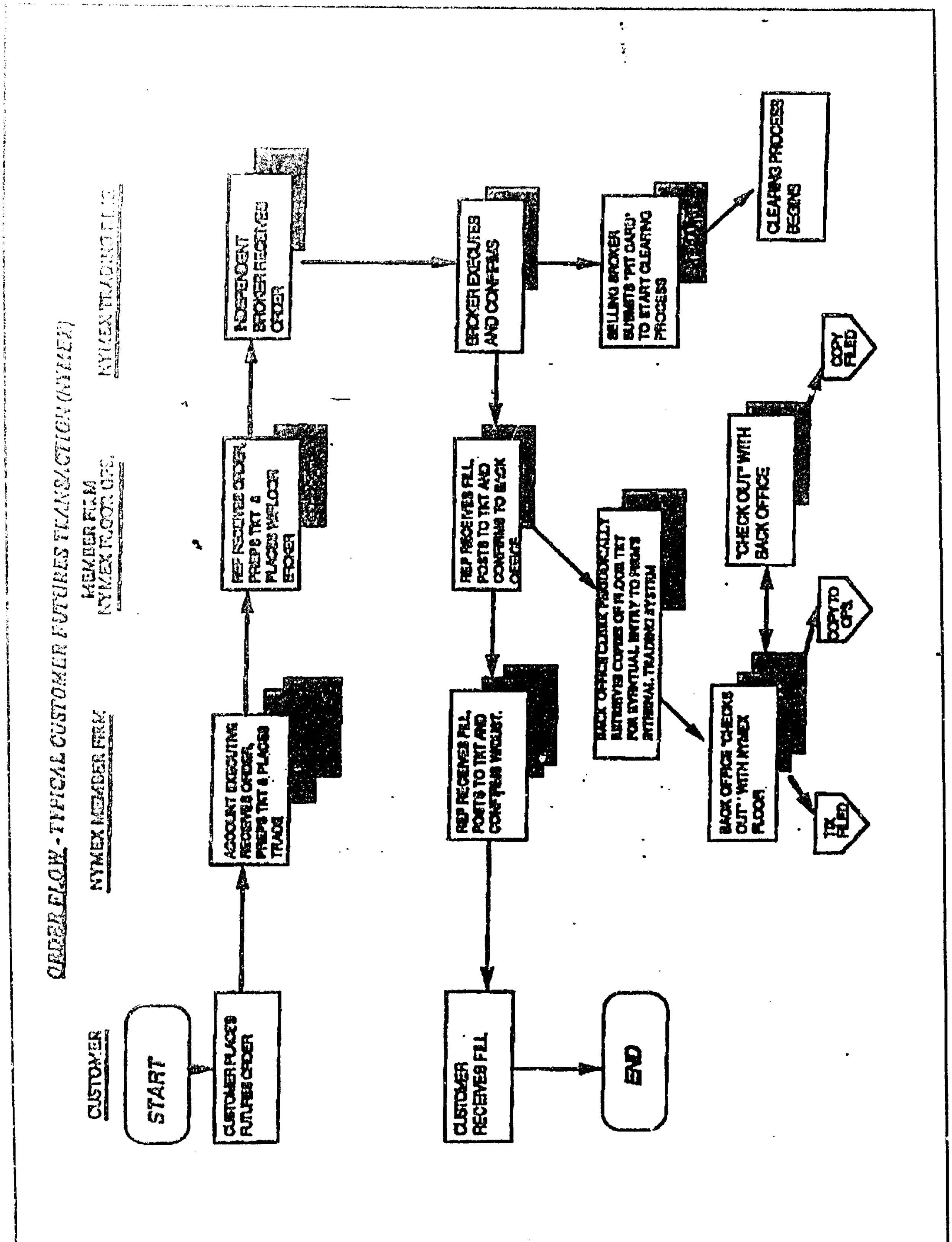
(NYMEX, April 1993)

Figure 7 Wall Street Journal Options Listing

C. FUNCTION AND USE

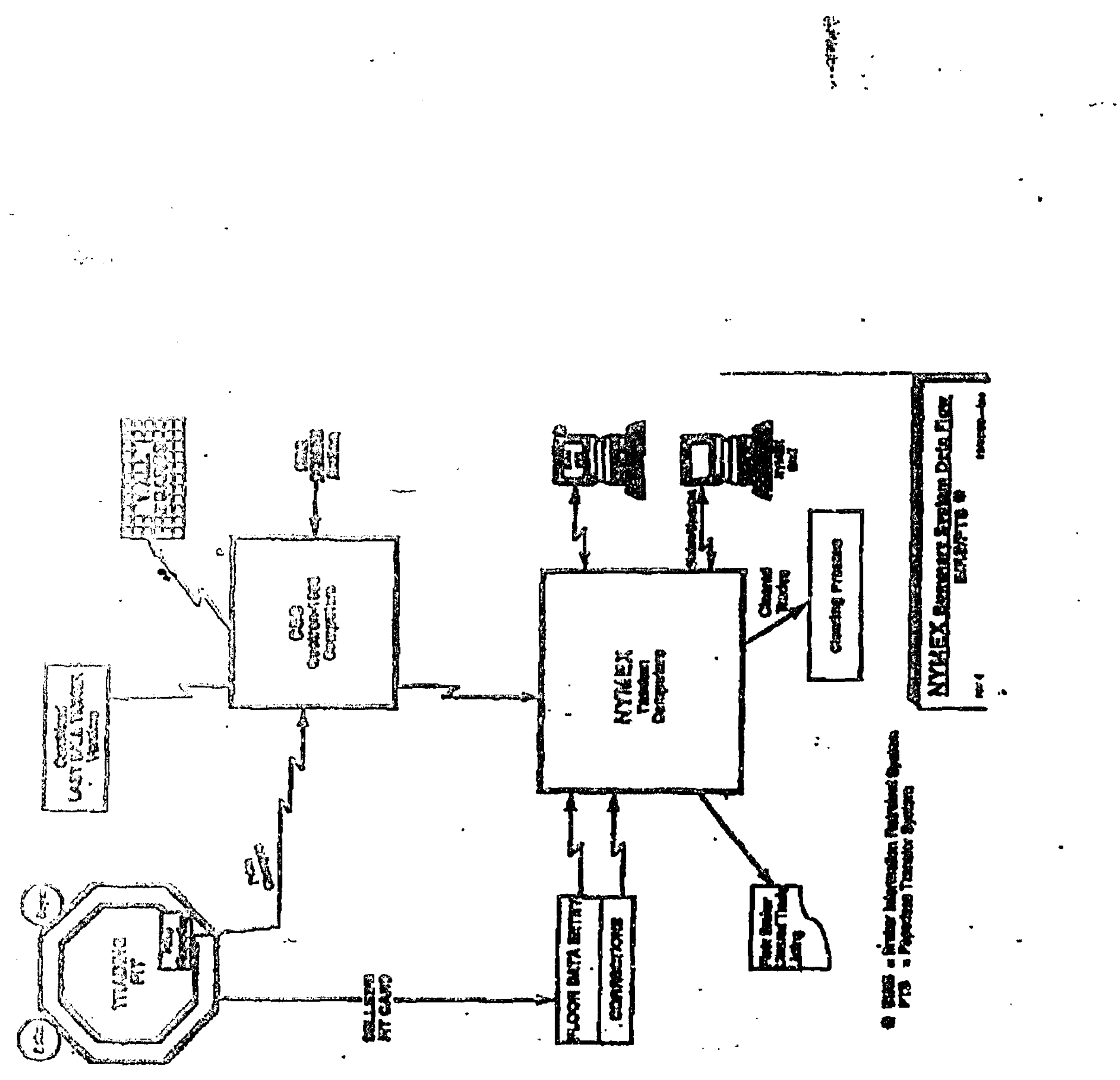
The futures market provides two valuable functions, price discovery and risk shifting. Futures contracts are traded through a system called "open outcry," basically verbal bids in public auction, on a regulated exchange. Futures contracts are standardized, hence have tradeable value similar to stocks or bonds. Purchases and sales prices are transmitted immediately around the world to be seen, or discovered, by all market participants. The prices reported on the commodity exchanges thus reflect a world market consensus of commodity price expectations in the future, and constantly change to match these world expectations. Figure 8 shows the typical flow of trading transactions, while Figure 9 shows the flow of information as it generally occurs on the trading floor of the NYMEX Exchange in New York. Trade activity and information moves at an astounding pace. In fact, NYMEX regulations require floor brokers to report each completed trade transaction within 60 seconds of occurrence. (NYMEX, 1993)

The other valuable function performed by the futures market is risk shifting. There are basically two types of traders in the futures market, hedgers and speculators. A hedger wishes to protect the value of an underlying commodity he intends to buy or sell at some time in the future. His desire is to shift the risk associated with this future event



(NYMEX, April 1993)

Figure 8 NYMEX Trade Transaction Flow



(NYMEX, April 1993)

Figure 9 NYMEX Trade-Information Flow

onto someone else. A speculator, on the other hand, trades in the futures market to make a profit. A speculator wishes to accept the risk of a future event in exchange for some premium that can be realized at the time the futures contract is traded. (NYMEX, 1993)

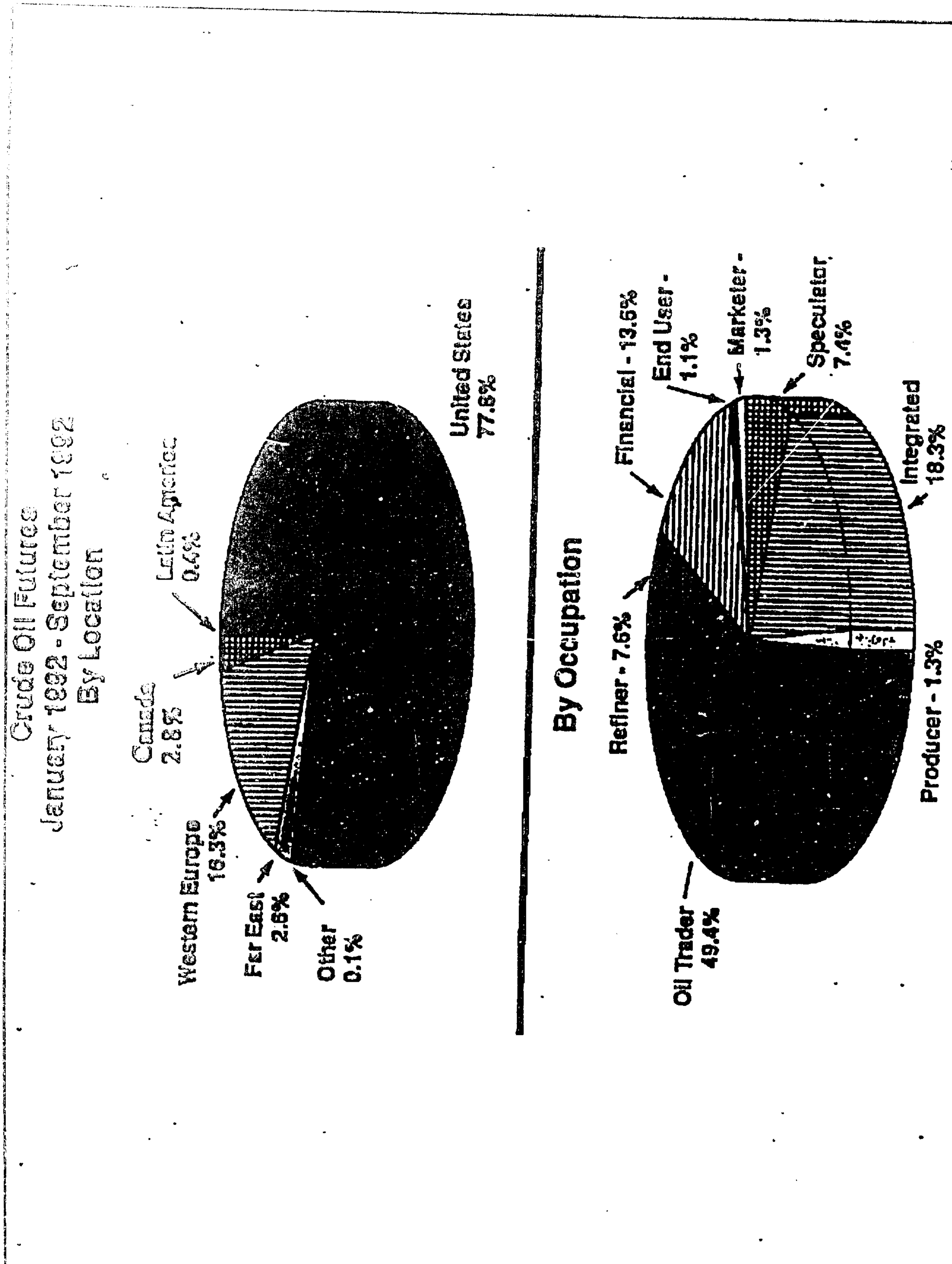
In general, a hedge is an open position taken in the futures market, either a buy position called a long, or a sell position called a short, that establishes a guaranteed price in the future for a commodity that will also be bought or sold in the spot or cash market (NYMEX, 1993). A refiner would sell a futures contract to hedge against the possibility that oil prices for products he intends to sell would fall in the future. As an end user or intermediary, DFSC would buy a futures contract to hedge against the possibility that oil prices for products it intends to buy would rise in the future.

From a producer's point of view, he can sell his intended production forward, even before it is actually produced. He locks in his price and thereby knows his level of risk in advance. The buyer is also able to lock in his purchase price and he thereby knows his level of risk in advance as well. Both buyer and seller are hedging their risks against each other with opposite positions and trading goals. Speculators usually take positions on both sides, and are willing to accept risk for the potential of profit. The object for each buyer and seller engaged in hedging is to minimize his own risk and reduce exposure to price volatility. (Yergin, 1992, p. 724)

Hedging, like an insurance policy, transfers risk from the policy holder to an underwriter, in this case from a hedger to a market filled with both speculators and other hedgers, but with opposite investment goals. Figure 10 gives the relative size of the various futures market participants. As can be seen, speculators comprise only 7.4 percent of the market. Empirically, it is the opposite trading goals of hedgers that have the greatest impact on futures prices. However, speculators are extremely important in the efficient operation of the futures market. Not only do speculators assume risk in return for potential profit, but they also provide essential market liquidity. (NYMEX, 1993)

Because futures contracts have tradeable market value, a futures position may be terminated or closed by a reversing transaction any time prior to expiration. For example, the refiner would buy a futures contract to close his hedge, while DFSC would sell its futures contract to close its hedge. This ability to reverse and close positions allows the trader an opportunity to pull out the monetary savings from the hedge without actual physical delivery of the underlying commodity. (NYMEX, 1993)

If futures contracts are hedged against actual quantities at risk in the physical cash or spot market, savings in the futures market will always offset losses in the physical



(NYMEX, April 1993)

Figure 10 Futures Market Participants

market, and vice versa. This phenomenon is due to the differential price that is realized through buying or selling the actual, or underlying commodity, in the physical market at the same time a position is held in the futures market. Hence, the effect of a fixed-price contract is achieved without the actual use of one. (NYMEX, 1993)

For example, suppose oil was trading for $25 in January, but DFSC decided to take delivery in June using a contract that was indexed to the spot market. In June DFSC would have to pay whatever the spot price was at the time of delivery. Suppose in January DFSC also decided to hedge its June delivery, and bought a futures contract for $25. Suppose that when June came, the spot price jumped to $30. In the physical market DFSC would have lost $5 because the price went to $30, and it would have to pay $5 more than was expected in January. However, in the futures market, DFSC could have sold its futures contract in June for $30, and would have gained $5 over the cost it paid in January. Hence, losses in the physical market would be offset by gains in the futures market, and an effective fixed procurement cost of $25 would be achieved without using an actual fixed-price contract.

Futures contracts can also be developed in tandem with options. Since options provide buying and selling rights without actual obligation, for the cost of a premium, they afford hedgers even greater protection and flexibility in achieving individual trading goals. They also provide speculators another source of premium earnings to improve their profit potential. A hedging futures contract coupled with a put options contract, would not only offer risk protection against market price increases, but would also offer price participation during market price decreases.[11]

Using the same example, suppose in June the spot price dropped to $20. In the physical market DFSC would have saved $5 because the price dropped to $20 and was $5 lower than expected in January. However, in the futures market DFSC would be forced to sell its futures contract in June for $20. It would have lost $5 over the price it paid in January. In this situation, gains in the physical market would be offset by losses in the futures market. Unfortunately, if the spot price dropped to $20, the effective procurement cost would still be fixed at $25 because of the futures market position.

Suppose in January DFSC had also bought a $25 put option for a small premium. The $25 put option grants DFSC the right but not the obligation to sell the underlying futures contract for $25 no matter what the spot price becomes. If the June spot price jumps to $30, the put option becomes worthless and the effective procurement cost becomes $25 plus the cost of the premium paid on the put option. If the June spot price falls to $20, DFSC can now sell the futures contract for $25

[11] Interview between R. Seide, Marketing Manager, New York Mercantile Exchange, New York, NY, and the researcher, 27 August 1993.

and the effective procurement cost becomes $20 plus the cost of the premium paid on the put option. In this example, by buying the hedging futures contract and put option together, DFSC would be able to protect itself against spot price increases, and would also be able to participate in spot price decreases.

D. SUMMARY

While oil has been bought and sold in the spot market since its discovery, futures trading in broad based oil commodities has only occurred since 1983. Unlike the spot market, futures market prices represent a world-wide consensus of market price expectations. In the United States, the futures market is heavily regulated and monitored by both the CFTC, and the commodity exchanges. Many safeguards are in place to prevent manipulation, and provide market stability. There are only three exchanges in the world that trade in oil futures contracts. The NYMEX Exchange in New York is the largest. The futures market provides two valuable functions, price discovery and risk shifting. The market is comprised of both hedgers and speculators who use the market to achieve different trading goals. The Defense Fuel Supply Center would trade as a hedger.

IV. FACTORS AFFECTING THE UNDERLYING PRICES OF OIL

A. CHAPTER OVERVIEW

This chapter describes the primary factors that drive prices in both the spot and futures markets. This chapter also explains the primary differences that exist between the two most popular methods of market analysis. Finally it explains the connection between futures market prices and the spot prices of the underlying oil commodities they represent.

B. PRIMARY FACTORS

1. Supply and Demand

There are many factors that affect the price behavior of oil in the various markets. However, taken in aggregate these factors create certain technical and economic conditions that establish key relationships between oil production and oil consumption. These key relationships then become the basic foundation for price formulation in both the spot and futures markets. (MacAvoy, 1982, pp. 5-39)

At its most rudimentary level, oil production is a function of the aggregate yet independent exploration of natural resources leading to the discovery of new oil reserves, and their subsequent exploitation and conversion into marketable products. Of key importance, is the size, location, and number of proven reserves, as well as the productive capacity of the industrial infrastructure. Production is heavily influenced by the rate at which existing stocks are depleted and new reserves are discovered. (MacAvoy, 1982, pp. 5-39)

Consumption is a function of aggregate consumer income, population growth and economic activity. Consumption is heavily influenced by the desirability of the oil products produced and preferences over other energy alternatives. Production establishes the foundation of world oil supply while consumption establishes the foundation of world oil demand. In general, the interaction of supply and demand in the presence or absence of regulatory intervention establishes market price. (MacAvoy, 1982, pp. 5-39)

Various supply and demand relationships influence price. Figure 11 compares the average West Texas Intermediate (WTI) price against drilling production, refinery throughput, and consumption. From 1973 until about 1985, oil prices were heavily influenced by OPEC (Organization of Petroleum Exporting Countries). World production was tightly controlled and consumption was fairly constant. In 1985, Saudi Arabian production initially bottomed out at 2.34 million barrels per day to support the OPEC price. Disgruntled over the tremendous loss in revenue associated with this production level, the Saudi Oil Ministers boosted production to fund internal projects. With a break in the OPEC cartel, the price collapsed. From that market correction in 1986 through today,

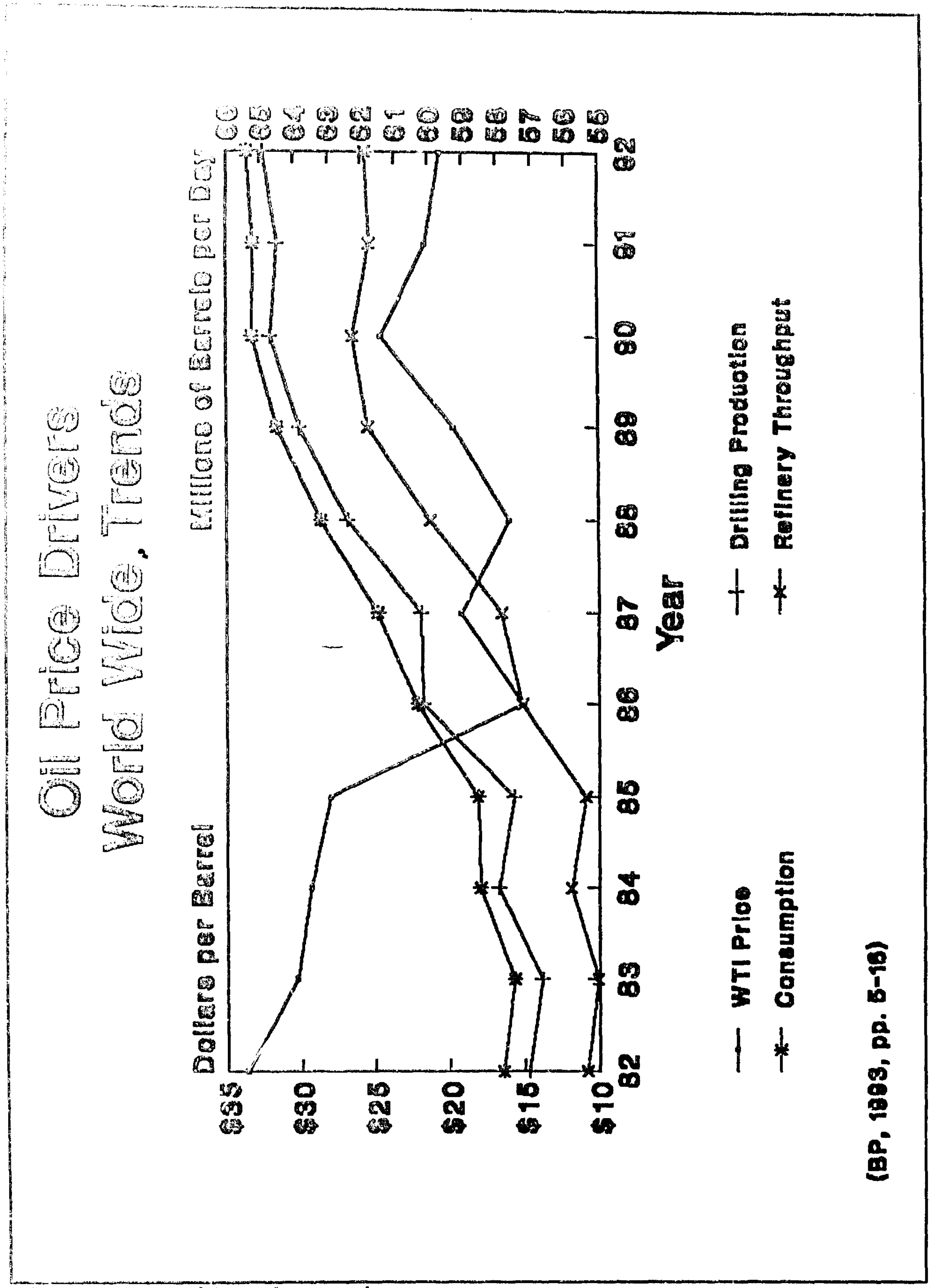


Figure 11 Oil Price Drivers

the price has generally followed the volume of activity from both production and consumption. (*Energy in the News*, 1993)

Figure 12, compares the WTI price against excess refining capacity.[12] As the price declined from 1982 through 1988, many small refineries went out of business. Statistics collected by DFSC show a decline of nearly 100 operable domestic refineries during this period. Most of these refineries had a capacity of less than 50,000 barrels per day (DFSC, 1991, p. 13). As the price began to increase in 1988, greater profit potential brought refiners back into the business. During this later period, DFSC statistics show a slight increase in the number of operable domestic refineries in the greater than 50,000 barrel category, but still show decreases for refineries less than 50,000 barrels capacity (DFSC, 1992, p. 13). This means that there are operating inefficiencies and greater barriers to entry at the lower end of the capacity scale.

Figure 13 compares the WTI price with excess consumption.[13] From 1987 through the present, it appears as if the general trend of excess consumption is opposite to the price. While the price in general is rising, excess consumption appears to be falling.

[12] Excess refining capacity equals refining capacity minus throughput.

[13] Excess consumption equals consumption minus drilling production.

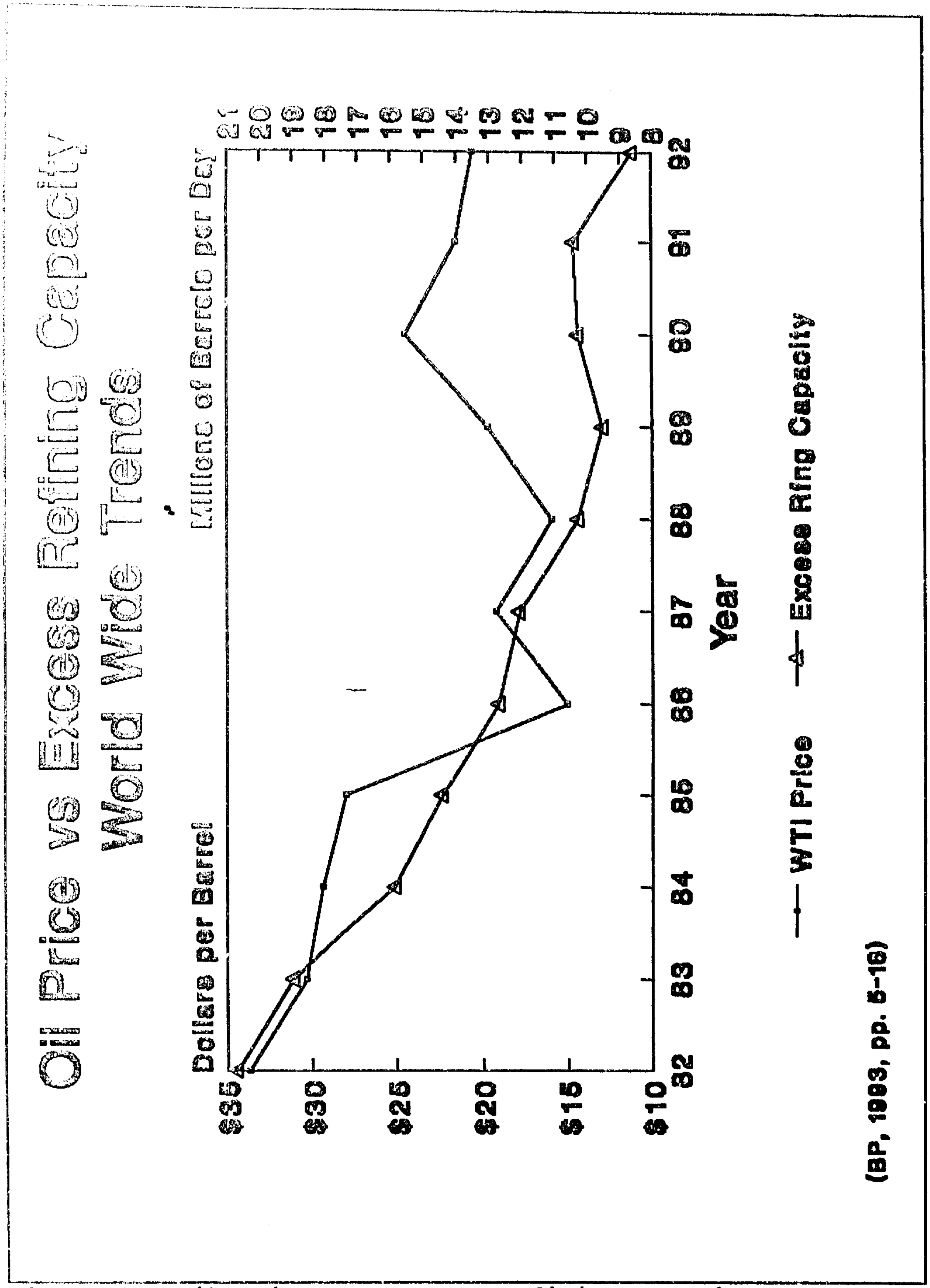


Figure 12 Oil Price vs. Excess Refining Capacity

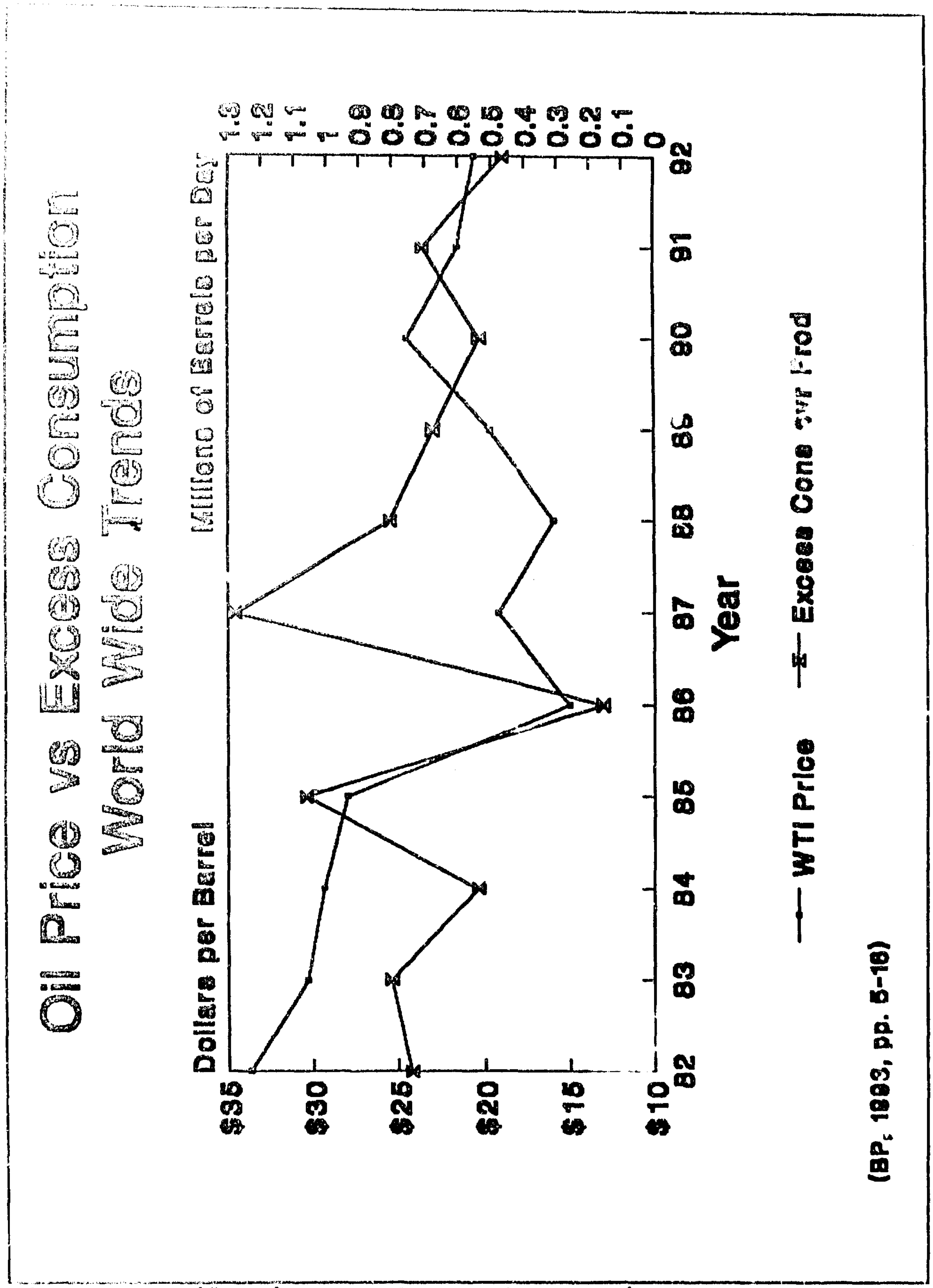


Figure 13 Oil Price vs. Excess Consumption

Figure 14 compares the WTI price with international trade activity. Since 1986, the volume of trade appears to precede the general movement in price.

2. Properties and Quality

In reality, there is no single world oil price. Price varies depending upon certain intrinsic as well as extrinsic qualities, including sulfur content, distillation fractions, transportation costs, and numerous other factors. (Horwich, 1984, p. 197)

Of primary importance to the price of crude oil is its sulfur content and its API (American Petroleum Institute) gravity. Table V provides the sulfur content and API gravity for many common crude oils. Low sulfur crude oils, called "sweet" crudes, are much easier to refine than high sulfur crude oils, called "sour" crudes. A sweet crude is defined as having less than 0.25 percent by weight of sulfur. Sweet crude oils yield greater quantities of high value products like naphtha and gasoline and are generally more expensive than sour crude oils. Sour crudes have more than 0.5 percent sulfur by weight and comprise more than 60 percent of world production and 80 percent of the economically recoverable petroleum reserves (NYMEX, 1993, p. 7).

API gravity measures specific gravity in terms of weight per unit volume. The API gravity index runs from 0 to 100, equivalent to the specific gravities of 1.076 to 0.6112

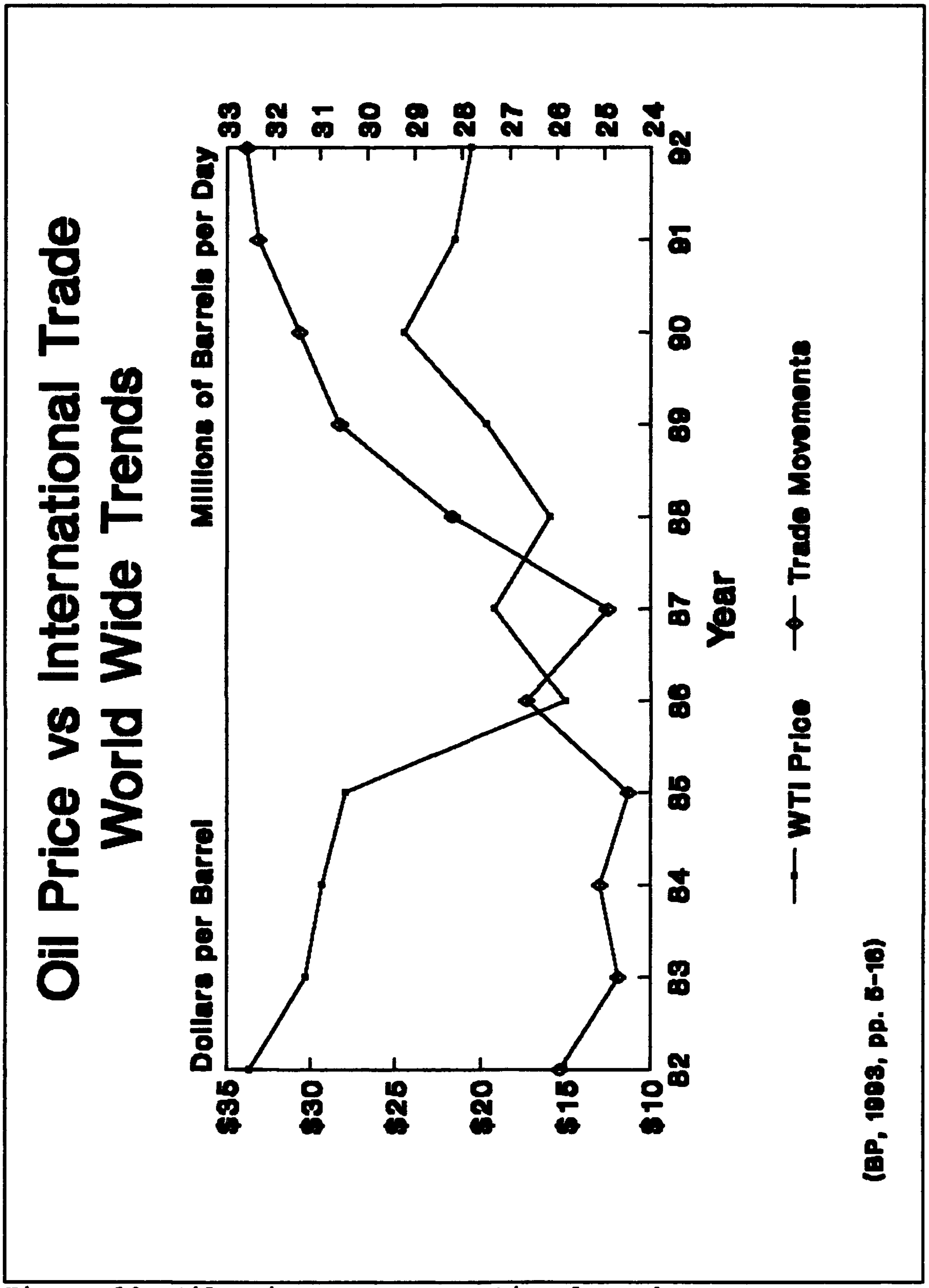


Figure 14 Oil Price vs. International Trade

TABLE V API GRAVITY AND SULFUR CONTENT

AVERAGE API GRAVITY AND SULFUR CONTENT OF U.S. AND FOREIGN CRUDE OILS

Crude Oil	API Gravity	Sulfur Content (weight percent)
United States		
California	26.2	1.05
East Texas	38.0	0.26
Gulf Coast	22.0	0.19
West Texas	36.0	1.38
Average U.S.	34.7	0.75
Foreign		
Indonesia	35.0	0.09
Iran		
Light	34.0	1.35
Heavy	31.0	1.60
Kuwait	31.0	2.50
Nigeria	34.0	0.16
Saudi Arabia		
Light	34.0	1.70
Berri	39.0	1.16
Heavy	27.0	2.85
Medium	31.0	2.40
Venezuela	26.0	1.52

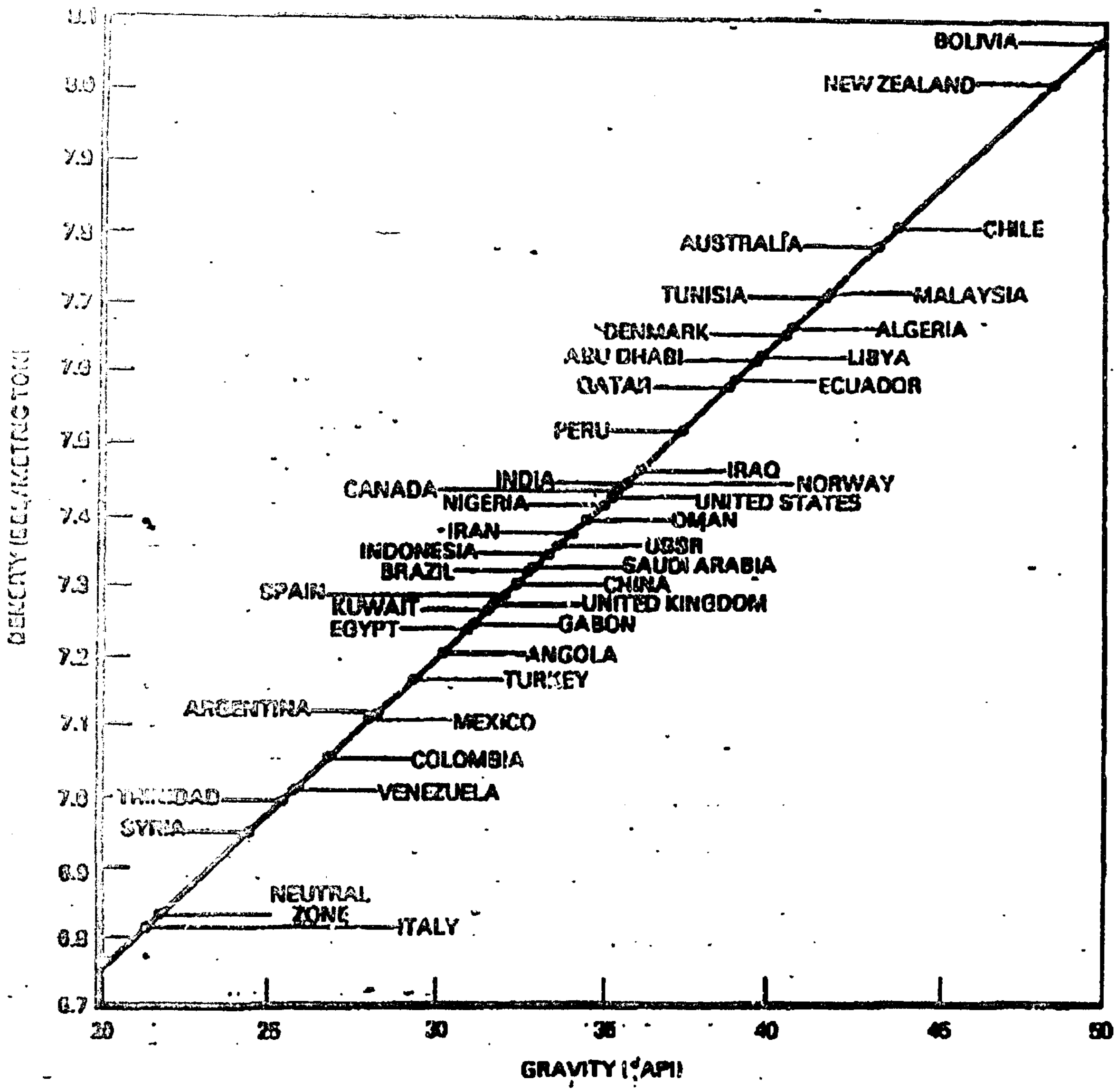
(Navy, 1979. p. 52)

(Navy, 1979, p. 52). API gravity plays a major role in transportation costs. Oil is priced in dollars per barrel, but freight rates on oil are given in terms of dollars per metric or long ton. Higher gravity crude oils, meaning lighter ones, would represent more barrels per ton to be transported for the same cost. In other words, higher gravity crude oils cost less per barrel to transport than lower gravity crude oils. (Rifai, 1975, pp. 73-74)

Figure 15 shows the API gravity and barrels per metric ton for many common crude oil sources. Figure 15 also shows that Bolivian oil, being much lighter because of higher API gravity, is much cheaper per barrel to transport than Italian oil.

3. Products and Refining

Crude oil is converted into more than 2,500 products and over 3,000 petrochemicals (Navy, 1979, p. 52). These include fuels, lubricants, paints, dyes, soaps, explosives, compounds, insecticides, waxes, asphalts and other lesser known products. Of these, the major fuels like gasoline, heating oil, diesel fuel, and other residual fuels have become the most prominent, both in terms of the revenue they produce and the politics they evoke. These four categories of fuel, determine more than 90 percent of the total value of crude oil. Each product is traded in its own separate market and must establish market equilibrium and price with relative independence from every other product. What is interesting to note is that the type of crude oil used to make each product



Source: *Petroleum Engineer International*, July 1978.

AVERAGE NUMBER OF BARRELS OF CRUDE OIL PER METRIC TON BY PRODUCING COUNTRIES

(Navy, 1979, p. 53)

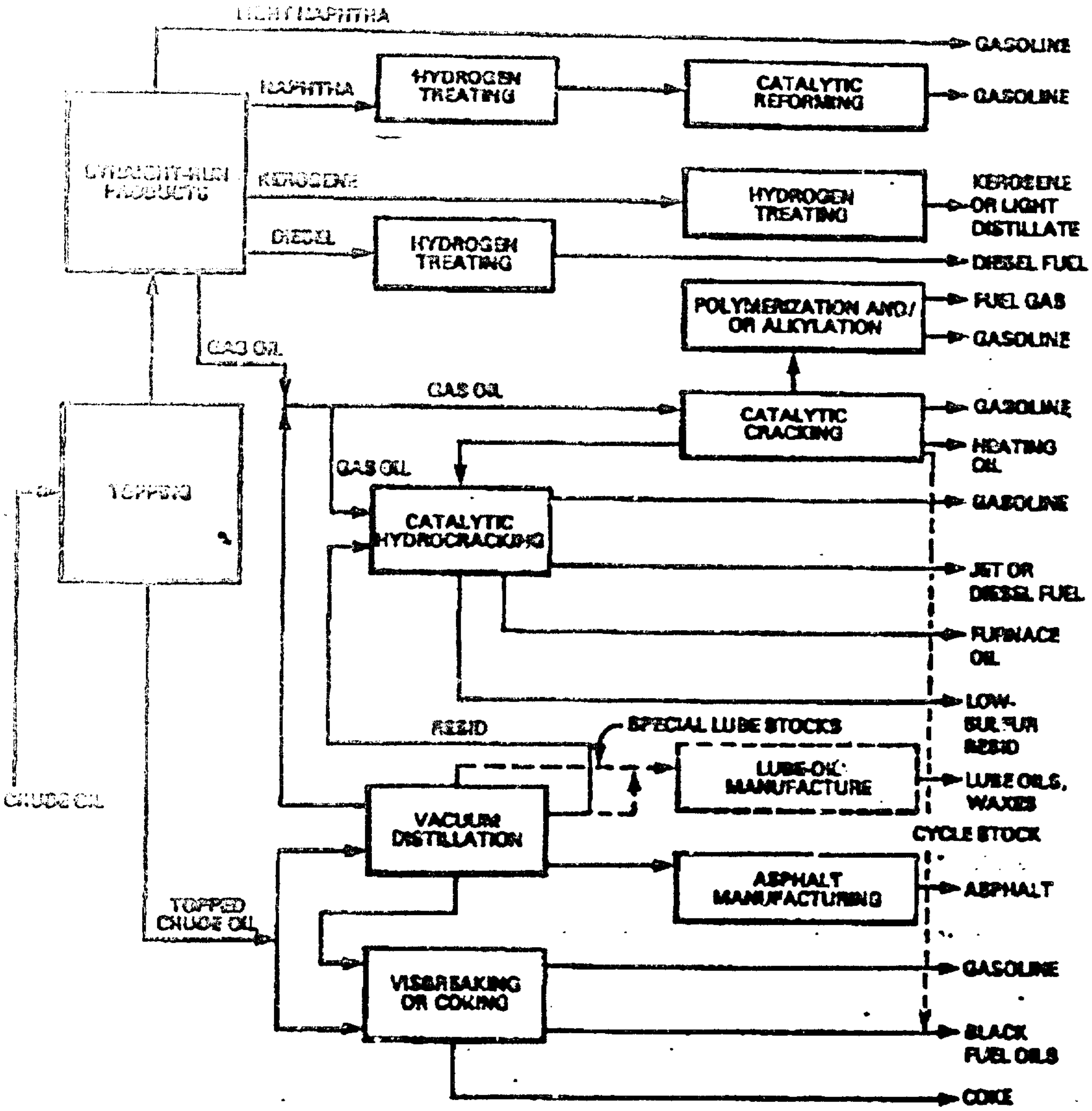
Figure 15 Crude Oil Barrels per Metric Ton also has great bearing on its ultimate price. (Cassady, 1954, pp. 6-28)

There is some disagreement over which price is more important, the crude oil price, or the aggregate price of products. From one point of view, crude oil sets the price foundation and pace for all other petroleum products to follow. However as a raw material, crude oil has little intrinsic value except to a refiner. According to the tunnel theory, crude oil's value is derived from the worth of products which can be made from it. According to this point of view, the key to understanding crude oil price movements is to understand the movement of its product prices. These product prices establish a floor and a ceiling, or a tunnel of price ranges in which a refiner would be willing to buy crude oil. From this theory, the marginal value of crude oil to a refinery can be derived by determining the percentage yield and value of all of its products. (Ervin, 1984, pp. 376-382)

The quantity and value of the product itself is constrained by the physical chemistry of the crude oil from which it came and the sophistication of the refinery through which it is processed. For example, jet fuel is usually produced from the simple distillation of light crude oil. Gasoline is made from an entirely different process, generally using heavy crude oil. The gasoline refining process usually consists of either breaking up large hydrocarbon molecules, or combining smaller ones, much more complicated processes than simple distillation. (Wald, 1990, p. E-7)

At the same time, Venezuelan crude oil is much heavier than oil from Kuwait, and Saudi Arabian crude oil is much heavier than oil from Iraq. Both Venezuelan and Saudi Arabian crude oil have fewer of the chemical bonds required to make jet fuel. However, these crude oils do not adversely affect gasoline, which has chemical properties at the other end of the physical spectrum. This is one reason why the difference between the cost of crude oil and gasoline was 60 percent lower after the invasion of Kuwait. Gasoline was simply being made from a better mix or vintage of crude oil. (Wald, 1990, p. E-7)

Figure 16 shows a basic schematic for a relatively sophisticated refinery. Topping is the first operation in nearly all refineries. Here light or straight run products are distilled and separated from heavier products called topped crude oil. The lighter products are then fractionated, or separated by layer in a vertical column, and subjected to high temperatures. With heat they decompose, or crack, into smaller molecules. In the hydrogen treating process, sulfur is removed from the fractionated products by creating hydrogen sulfide gas. Gasolines are then sent to a catalytic reforming unit where molecules are added to improve their octane. The middle distillates from the fractionation unit are blended to



Source: *Kirk-Othmer Encyclopedia of Chemical Technology*, 2nd ed., Vol. 15 (New York: John Wiley and Sons, [illegible]).

BASIC REFINERY OPERATIONS

(Navy, 1979, p. 54)

Figure 16 Basic Refinery Operations

form jet fuels, diesel fuels, and heating oil. (Navy, 1979, pp. 54-57)

What determines the sophistication of a refinery is how efficiently it can convert the heavier or topped crude to more valuable lighter products. Catalytic cracking takes topped crude and produces lighter products by exposing hot oil feedstocks to a catalyst in a continuously circulating system. Catalytic hydrocracking is a more sophisticated process done at much higher temperatures and pressures. Hydrogen is consumed by the feedstock as it is exposed to the catalyst, creating new hydrocarbon molecules. Catalytic hydrocracking gives a refinery much greater flexibility because it significantly improves the quantity of the lighter products produced over simple catalytic cracking. (Navy, 1979, pp. 54-57)

Older less sophisticated refineries generally rely on thermal cracking to break down the topped crude oil. Thermal cracking uses high temperatures to decompose the feedstocks. Coking and visbreaking are the only thermal cracking processes still in use. (Navy, 1979, pp. 54-57)

The refining process produces four broad categories of fuel. These are light gases, gasolines, distillates, and residuals. Light gasses consist of methane, ethane, propane, butane, and other light gasses called olefins. Gasolines are a complex mixture of hydrocarbons designed to promote high antiknocking qualities, low engine deposits, and prevent vapor lock in internal combustion engines. Distillates include jet fuels, diesel fuels, and heating oils. Distillates have very similar properties to kerosine. Residuals are the left over by products and are used mostly in industrial grade steam boilers. (Navy, 1979, pp. 58-59)

4. History and Politics

History and politics have played a major role in the price behavior of oil. A decade after gold was discovered in California, a different kind of gold prospecting was occurring in a tiny Northwestern town of Pennsylvania called Titusville. In 1859 on the shores of Oil Creek (Yergin, 1992, p. 789), a former railway conductor named Edward L Drake, who liked to call himself Colonel, became the first man to commercially pump the liquid commodity which has become so intimately intertwined with every facet of our modern society. (Ridgeway, 1980, p. 74)

However, the early years of the oil industry were quite different from today. For nearly half a century, oil was used almost exclusively for illumination. During that time, John D. Rockefeller was able to parlay the profits of a small produce business on the Cleveland docks into one of the most powerful corporations the world has ever known. Recognizing an opportunity, he started an oil refinery business with a partner that he later bought out. By 1879, his new business was refining and marketing more than 90 percent of all the oil produced throughout the United States. (Ridgeway, 1980, p. 75)

By 1882, Thomas Edison began to light cities with a different form of illumination. With his much safer electric lighting becoming more popular around the world, the oil business was forced to look for a new identity. In 1896, Henry Ford built his first automobile and the future of the oil business again began to look bright. (Yergin, 1992, p. 789)

However, 1911 would prove to be a more pivotal year. While this Nation's courts were breaking up Rockefeller's then monopolistic Standard Oil Company into 33 smaller companies, Winston Churchill, then first lord of the admiralty, was making a decision in Great Britain that would change the importance of oil in the world forever. Churchill decided that the warships of the British Empire would no longer be fueled with coal, but would run on oil. (Ridgeway, 1980, p. 75)

With Churchill's decision, oil became more than just a simple commodity. While oil has always provided massive wealth for individuals, companies, and even nations, Churchill's decision put oil at the center of national strategy, global politics, and world power. Oil has dominated world events ever since. Today it is still the Holy Grail of global politics and power. In fact, no other readily traded commodity has ever earned such strategic importance. (Yergin, 1992, p. 13)

While oil has fueled the pinnacle of our industrial achievements, it has also warned us of the depth of our dependence. No place on earth has proven us this fact more clearly than the Middle East. As explained in Chapter II, the nominal price of crude oil remained fairly constant for nearly 100 years. Then Western support for the Israelis during the Yom Kippur War caused the Middle Eastern Nations of OPEC to retaliate in protest.

The effect OPEC's actions had on the world price of oil was swift and dramatic. In September 1972, the Rotterdam spot price of crude oil stood at $3 per barrel. During the next three months, through the outbreak of hostilities between the Arabs and Israelis, the spot price of crude oil rose to $19 per barrel. After three years of 11 percent compound growth in output, OPEC suddenly reduced production by 10.5 percent and instituted a total embargo of shipments to the U.S. and other Western countries friendly to Israel. (Horwich, 1984, p. 57)

With great alarm, reduced production in this region precipitated a world-wide supply shock, driving crude oil prices to record highs. During the 1950s, the seven major oil companies in the Persian Gulf region (Esso, Mobile, SoCal, Texaco, BP, Gulf, and Shell) were already producing 53 percent of the world's crude oil supply (Adelman, 1972, pp. 78-83).

By the early 1970s, the major oil companies had all been nationalized by the OPEC governments, but the Persian Gulf region was now producing more than two thirds of the world's crude (Yergin, 1992, p. 718).

By the time of the Yom Kippur War, OPEC was in firm control of nearly 90 percent of the international crude oil market and 73.3 percent of the world's proven oil reserves (Ecbo, 1976, p. 2). With the world so heavily dependent on Persian Gulf oil, the production shortage caused by OPEC increased worldwide prices by 17 percent during 1973, and an additional 211 percent during 1974 (MacAvoy, 1982, p. 2).

In 1979 and 1980 another war in the Middle East caused similar problems. During the opening battles of the Iranian Iraqi war, cutbacks from these two combatants caused OPEC to reduce oil production below pre-1978 levels. The shortage initiated by this new crisis caused worldwide prices to rise another 63 percent in less than a year. (MacAvoy, 1982, p. 2)

Although the market power of OPEC is pervasive, as a cartel it faces a rather unique organizational challenge. The welfare of the group as a whole is only benefited if each of the members coordinate production decisions to limit output and elevate oil prices as if they were a single supplier. In effect, they must be able to unify their respective goals, resolve differences, and combine forces to act like a monopoly. (Moran, 1978, p. 1-28)

In contrast, the welfare to each individual OPEC member is increased only if it can expand its own production output, while still remaining under the organizational umbrella and stability of OPEC's market power. By offering renegade price discounts and avoiding disciplinary actions by the cartel or causing the cartel to fall apart, an individual member can beat the market price, attract hungry customers, improve personal market share, and thereby improve total revenue and profits. In effect, members are individually better off to act in their own self-interest and cheat the cartel as long as they can do it without some form of organizational retaliation. (Moran, 1978, p. 1-28)

Historically, world demand for OPEC oil production as a group had been relatively inelastic, but the world demand for oil production from any one particular country within OPEC can often be highly elastic. Since the marginal production costs of any individual member are generally small when compared to the cartel's asking price, the rewards and incentives for cheating are great. (Moran, 1978, p. 1-28)

As a consequence, each member must exercise self discipline for the common good and be assured that each fellow member will do the same in order to preserve the cartel's market strength. This mutual balance requires major economic agreement between member nations, either explicit or implied, as to the specific distribution of market share. It also requires some method of monitoring and enforcing that distribution agreement. (Moran, 1978, p. 1-28)

In the past, OPEC had a fortuitous advantage in dealing with the question of market share distribution and the problems of cheating. Member governments that needed to maximize revenues were already operating at near full capacity. Member governments with the greatest ability to expand output were not in need of the revenues that additional production could have generated. Production cutbacks necessary to balance supply and demand at prices dictated by OPEC were shouldered by low-population, low mobilization nations for whom the marginal utility of the foregone revenue was very low. Cheating on the part of a few high population, high-mobilization states was too minor to be of any consequence, and was tolerated by the cartel with minimal organizational detriment. (Moran, 1978, p. 1-28)

The treasure chest of OPEC's power in the past was the huge global dependence on Persian Gulf oil. But the genuine key to this treasure came from the cartel's relatively painless ability to limit production. That particular key was, in fact, dependent on Saudi Arabia and its willingness to act as the cartel's residual supplier, cutting back whatever exports were necessary to balance supply and demand at the OPEC chosen price. (Moran, 1978, p. 1-28)

By 1985, the world had dramatically changed. First, driven by the incentives of the higher prices and profits reaped in the 1970s, small independent oil companies called wildcats and major firms alike pressed hard to develop new reserves. Major finds in the North Sea, Alaska, Mexico, Malaysia, Angola, China and even within the continental United States began to produce and produce big. As these huge new finds began selling in the market, they also began to significantly reduce OPEC's slice of the available pie. (Yergin, 1992, pp. 715-769)

Second, the massive global march toward greater dependence on petroleum based energy was being reversed, significantly reducing the size of the pie itself. Coal staged an energetic reentry into the electrical generation market. Nuclear energy and natural gas use was expanding world-wide, and Japan was leading the way in high-tech energy conservation and fuel efficient automobiles. (Yergin, 1992, pp. 715-769)

Third, with greater non-OPEC supply and diminishing world demand, Saudi Arabia resisted further production cuts, in the face of now higher production costs and painful losses of revenue due to collapsing oil prices. In 1981 Saudi Arabia had earned $119 billion in oil revenues. By 1985, with declining market share and price, Saudi Arabia was scraping to earn $26 billion. At the time, their own infrastructure construction and societal modernization and mobilization plans needed funding. (Yergin, 1992, pp. 715-769)

The build-up in non-OPEC supply and a collapse in world oil demand reduced OPEC exports by more than 13 million barrels per day, or 43 percent of 1979 levels. A huge world oil glut developed that has continued until this day. Even through the recent Iraqi embargo, horrific oil well fires, and tremendous oil field destruction of the Persian Gulf War (Yergin, 1992, pp. 715-769), the world was pumping as much oil without Iraq and Kuwait as it had with them. (Wald, 1990, p. e-7)

Current world production has temporarily crippled OPEC's price setting power. However, while proven oil reserves have increased from 670 billion barrels in 1984 to over one trillion barrels today, the vast majority of proven oil reserves are still concentrated within the Persian Gulf region, as shown in Figure 17. While the Western nations of the world remain the heaviest oil consumers, emerging nations are just now beginning to industrialize. It may only be a matter of time before non-OPEC reserves are depleted through over production. If that happens, OPEC will again be in a position to rule the market and demand the price that it wants. (Yergin, 1992, p. 769)

C. MARKET ANALYSIS

The factors mentioned are but a few of the many that affect oil prices in the various markets. There are however, two primary means of analyzing them. These methods are called

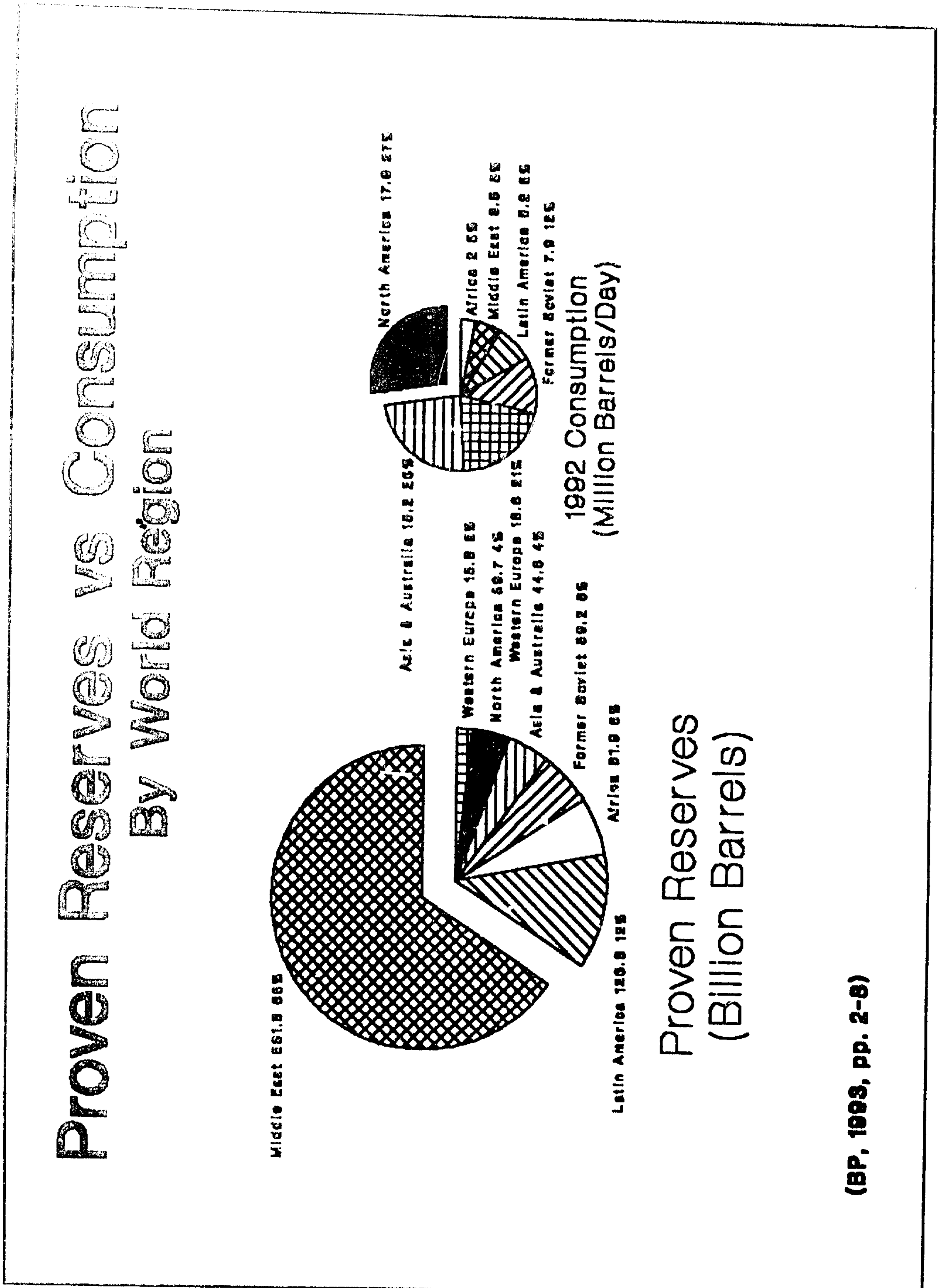


Figure 17 Proven Reserves vs. Consumption

fundamental analysis and technical analysis. Fundamental analysis seeks to make better decisions through finding better information about the underlying or fundamental factors behind market prices. Most of the information given in this chapter has been typical of what a fundamental analyst would consider prior to taking a position in the marketplace. Fundamental analysis tries to both understand the underlying economic issues involved in a particular commodity and determine an intrinsic price. It is considered to be the more scientific of the two approaches, but it is far more time consuming. It is also the approach most preferred by economists. (Francis, 1980, p. 665)

Most of the analytical work done in the Office of Market Research and Analysis at DFSC is fundamental analysis. Most of the effort is spent analyzing fundamental factors that could forecast market behavior or cause market prices to rise or fall.[14]

According to DFSC, some of the fundamental factors that could increase oil prices include:

- higher economic growth in the Western economies,
- a credible OPEC price and production pact,
- steeper decline in Russian production,
- or higher taxes in the consuming countries. (DFSC, 1993)

---

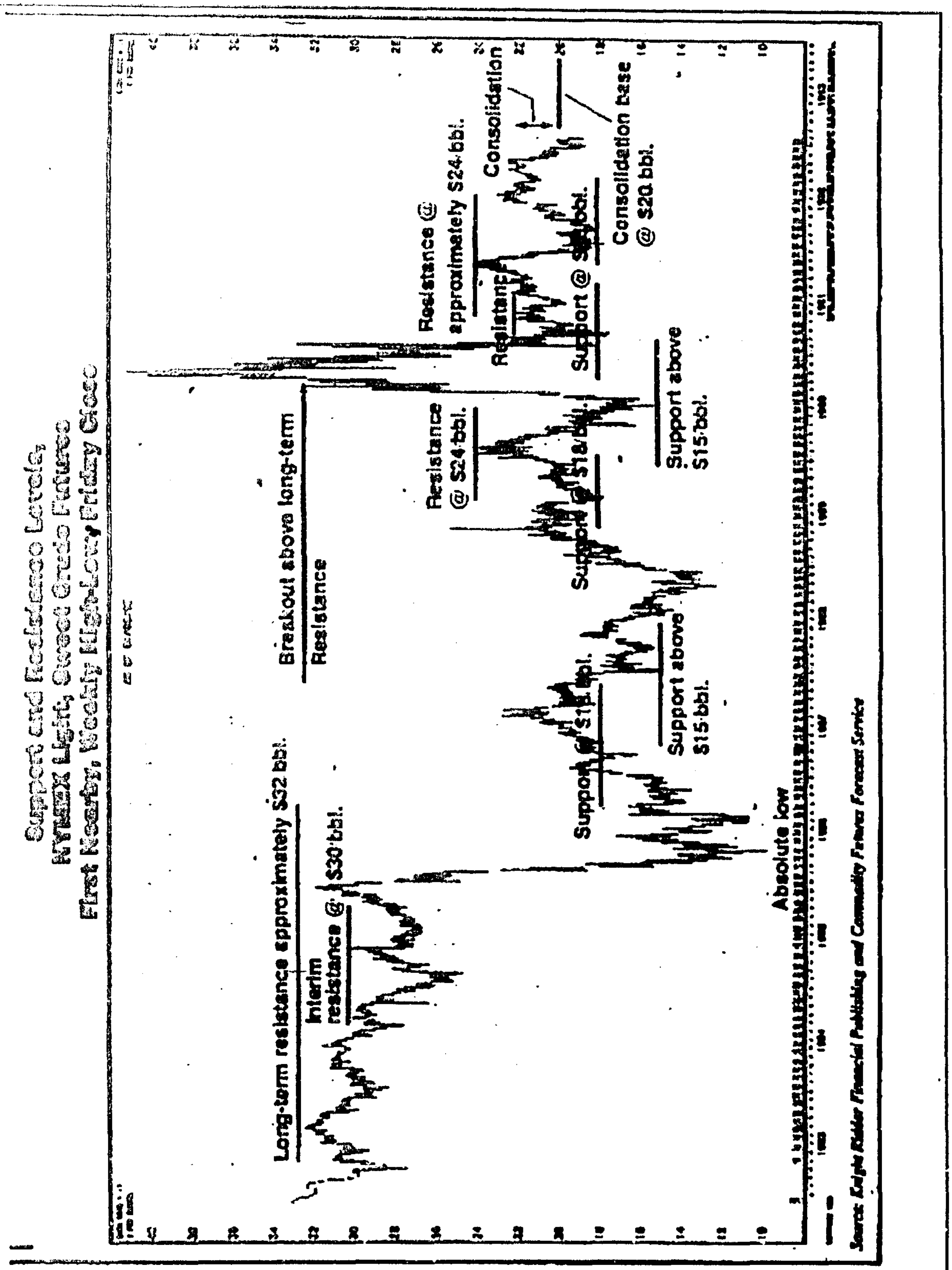
[14]Interview between L. C. Ervin, Industry Economist, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 24 August 1993.

Some of the fundamental factors that could decrease oil prices include:

- a renewed or deeper recession in the Western economies,
- an OPEC price war,
- unexpectedly high Russian exports,
- an early return of Iraqi exports,
- a technological breakthrough in conservation or oil substitutes,
- or lower taxes in the consuming countries. (DFSC, 1993)

Technical analysis provides an entirely different approach. Essentially, it looks for historical patterns in oil price movements. Technical analysts are popularly called "chartists" by the pundits because they generally catalogue their observations and predictions right on the price history chart. This technique is a favorite of many market traders. In fact, technical analysis has become a standard industry forecasting tool for the energy markets. (Gotthelf, 1993, p. 12)

Figure 18 is an example of a technical analyst's chart for futures market prices. Similar to the tunnel theory previously discussed, technical analysis tries to establish price ranges. The first step is to identify price extremes. The absolute low occurred in 1985 at just under $10 per barrel. The absolute high occurred in 1990 when the price jumped to over $41 per barrel.



(Gotthelf, 1993, p. 13)

Figure 18 Technical Analysis Chart

Taken alone, these price points provide little information. However, when compared with the next lower set of extremes, at a low of $15 per barrel and a high of $32 per barrel, a pattern begins to emerge. Essentially, the historical information reveals that only extreme circumstances, like the Saudi pumping spree of 1985 through 1986, or the 1990 Iraqi invasion of Kuwait would cause prices to reach such extremes. (Gotthelf, 1993, p. 13-14)

From 1989 through the present, the likely price range has been between a low of $18 per barrel, called a support, and a high of $24 per barrel, called a resistance point. More precisely, the price has tended to gravitate toward a range of between $20 to $22 per barrel, called a consolidation range. A sharp drop in prices from the support level, as occurred in 1989 to 1990, is called a bust. A sharp rise in prices from the resistance point, as occurred in 1990, is called a breakout. Busts and breakouts are usually short lived. (Gotthelf, 1993, p. 13-14)

Although this analysis may sound too simplistic, it is very popular with professional traders. Many have developed sophisticated computer models to spot and react to such trends with varying degrees of success. Technical analysis also has some degree of linkage to fundamental reasoning. (Gotthelf, 1993, p. 13-14)

> Consider what takes place when prices meet resistance. In simple terms, buyers are no longer willing to bid at higher prices. As the offers of sellers fail to match

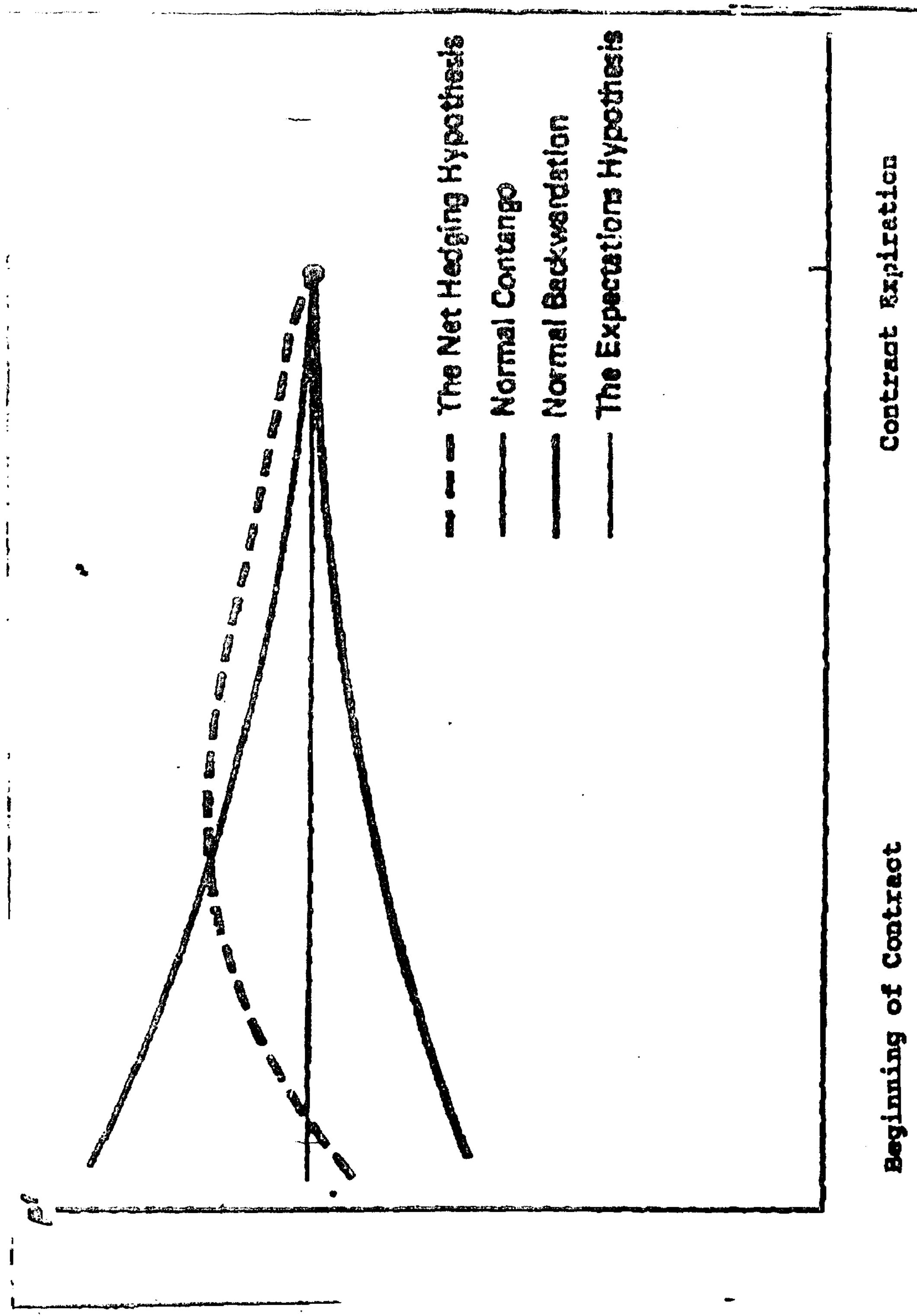
buyers' bids, prices retreat from this area of reluctance or 'resistance.' From a fundamental standpoint, buyers might be unwilling to bid higher prices because they can find an alternative source of energy (or crude) at the same or lower price. Or they may not have enough money to meet higher prices. More likely, they are simply confident that the product can be secured at the same or lower prices. Support comes into play when sellers are no longer willing to part with their commodity at lower prices. Buyers make lower bids and sellers reject the proposed transactions. Obviously, the situation is the same as resistance in reverse. Consolidation occurs when buyers and sellers generally agree that prices are appropriate. In a 'consolidation triangle,' we know that buyers and sellers are agreeing to a narrowing range. In a band consolidation, prices bounce off well-defined and generally narrow support and resistance. Unless there is fundamental change in energy production or consumption, long consolidations represent price ranges that are likely to repeat as consolidations. A breakout above a consolidation suggests that prices are abnormally high and will retreat back to the consolidation at some stage. A bust below consolidation suggests that prices will retrace back up to the consolidation at some point. Again, this may sound like 'what goes up must come down.' But, there is a twist. We have a way to determine the most likely place prices will eventually settle. Congestion is a term used to describe several market conditions. Over the years, the real meaning has been blurred. However, congestion commonly refers to a price level that has attracted above average volume and open interest. This may also be described as an 'accumulation' within a narrow range. Congestion implies subsequent volatility. If prices breakout from congestion, an unusually large number of short sellers will be forced to cover or margin up. If short sellers cover, their orders will force prices higher. The same logic suggests that a bust below congestion will result in a mass exodus of buyers. (Gotthelf, 1993, p. 15)

Obviously, both types of analytical approaches have their advantages. Fundamental analysis seeks to understand the underlying market conditions. Technical analysis seeks to identify the repeatable trends. In the final assessment, both approaches are useful and both are widely used.

D. CONNECTION BETWEEN MARKETS

While a futures contract is nothing more than an agreement between two parties for delivery of a particular quantity of a commodity at a specified place, price and time in the future, there is some disagreement as to the actual linkage between the futures price and the spot market price of the underlying commodity. This disagreement basically revolves around four different theories. Each theory predicts a different price at the beginning of a futures contract, but all theories converge as the contract reaches expiration. These theories are called the expectations hypothesis, normal backwardation, normal contango, and the net hedging hypothesis. All four theories are depicted in Figure 19. (Sharpe, 1981, p. 489)

According to the expectations hypothesis, the current price of a futures contract is the same as the market consensus expectation of what the spot price will be at the delivery date. If this theory is correct, a speculator could neither expect to win nor lose by taking a position in the futures market. His expected profit or loss is the expected spot price at delivery minus the current futures price. Under the expectations hypothesis, this expected amount is always equal zero. His actual profit or loss is determined at contract expiration, and is the actual spot price at delivery minus the current futures price. The actual profit or loss could be positive, negative, or zero. This theory implies



(Sharpe, 1981, p. 489)

Figure 19 Futures Pricing Theories

that speculators are indifferent to risk and are happy to accommodate hedgers without compensation. In fact, investors seeking to diversify equity portfolios often act in a risk indifferent manner when buying futures contracts because the betas of futures contracts generally offset the betas of equities. (Sharpe, 1981, pp. 486-489)

A beta is simply a measurement of how much a particular security price will change given a general movement in the market. Offsetting betas for a portfolio of securities allows the portfolio to approximate market performance, thus negating the risk of any particular holding within the portfolio. This phenomenon is the whole reason behind diversification. (Brigham, 1992, pp. 166-167)

John Maynard Keynes, a famous economist who also made a fortune in the futures market, was an advocate of normal backwardation. He suggested that on average hedgers are short the commodity. In other words, they wish to sell the underlying commodity in the future. According to Keynes, hedgers wish to transfer risk to long speculators, or buyers willing to agree in advance to future purchases. Long speculators must be enticed by an expectation of future profits to assume current risk. This implies that a futures price is likely to be lower than the expected spot price at expiration. Thus, the futures price will rise as it approaches expiration. (Sharpe, 1981, pp. 486-489)

Advocates of normal contango argue that on average hedgers are long the commodity. In other words, they wish to buy the underlying commodity in the future. These hedgers, must transfer risk to short speculators, or sellers. Short speculators, must also be enticed by an expectation of profit. Since normal contango is just the opposite of normal backwardation, it implies that a futures contract price will likely be higher than the expected spot price at expiration, and will decrease as it approaches expiration. (Sharpe, 1981, pp. 486-489)

A fourth theory, the net hedging hypothesis, holds that hedgers may need to find both long and short speculators during different parts of the contract life. Figure 19 shows a net hedging hypothesis futures contract that starts as normal backwardation, crosses as an expectations hypothesis, then converts to normal contango as it gets closer to expiration. The premise of this theory is that the net effect of the numbers and positions of all the hedgers and speculators in the market at one time will determine which hypothesis characteristic is appropriate. (Sharpe, 1981, pp. 486-489)

Whatever theory is applicable throughout the life of the futures contract, at the time of expiration, all theories converge and equal the spot price. This convergence occurs because at expiration a futures contract becomes a spot contract. This contract conversion feature is the ultimate link that ties futures market and spot market prices. (Sharpe, 1981, pp. 486-489)

According to Richard Seide, Marketing Manager for the New York Mercantile Exchange, oil futures generally exhibit normal backwardation.[15] Empirical evidence also verifies this observation. As shown in Figure 20, prices for successive futures contracts in series generally are lower in each succeeding expiration month. As contract duration gets longer, a short hedger must accept a lower price for a commodity he wishes to deliver in the future, exactly what is expected under conditions of normal backwardation. This condition favors long speculators because they initially receive a risk premium from the short hedger in the form of lower current futures prices to compensate for higher expected spot prices at contract expiration. Since the Government would always be hedging long, it could take advantage of this market condition and benefit from the risk premium normally given to long speculators.

E. SUMMARY

Oil prices in both the futures and spot markets are affected by many factors. There are factors relating to supply and demand, the characteristics and properties of oil,

[15]Interview between R. Seide, Marketing Manager, New York Mercantile Exchange, New York, NY, and the researcher, 27 August 1993.

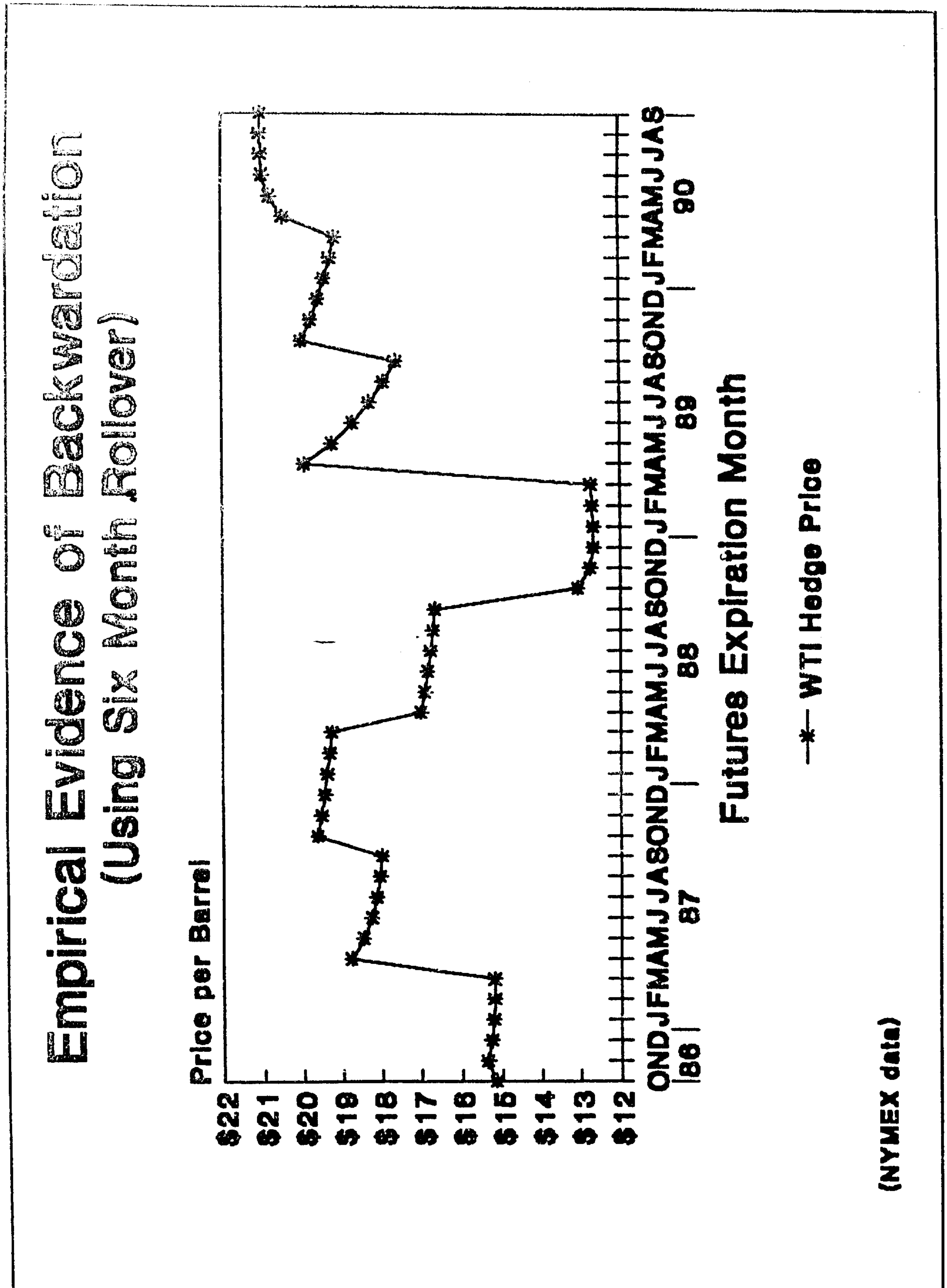


Figure 20 Empirical Evidence of Backwardation

the products and refining processes involved, and the nature of oil history and its politics. While there are basically two different approaches to analyzing these factors, both approaches can prove useful. The linkage between futures and spot markets prices can be described by four different theories. Each theory may initially produce different expectations, but all theories converge and agree at futures contract expiration. Finally, empirical evidence shows that oil futures normally behave in backwardation. As a long hedger, the Government could benefit from this market condition by automatically receiving the risk premium normally paid to long speculators in the form of lower futures prices.

V. ASSESSING FUTURES PERFORMANCE

A. CHAPTER OVERVIEW

This chapter looks at potential ways of assessing and measuring futures trading performance. It explains basic trading strategy design and offers a workable strategy that could be used as a basis for developing more sophisticated strategies.

B. ASSESSING AND MEASURING PERFORMANCE

One way of assessing futures trading is through the economic concept of utility. Utility is best described as an abstract measurement of satisfaction or happiness. Things that improve your level of satisfaction, or give you greater happiness, also give you greater utility. (Francis, 1980, p. 551)

Because utility is an abstract concept, it has no absolute scale. In measuring utility it should be considered in the context of relative situations. For example, wealth has greater utility than poverty for most people. Most people would derive greater relative satisfaction and happiness from being comfortably well off than from being destitute. The absolute value of utility can not be measured in either case. However, it is possible to measure the relative utility of the two cases with respect to each other. (Francis, 1980, p. 551)

Futures trading essentially offers a choice between two relative situations. This relative choice is between an outcome that is certain versus one that is not. A futures contract allows a trader to fix the price of a commodity that will be bought or sold at some time in the future. Not using a futures contract exposes a trader to the uncertainty of future market conditions and prices. The question is, which choice provides the greatest relative utility. The answer depends on the risk preference of the trader and the relative return that can be derived from each of the two situations (Gates, 1992, pp. 3-5).

There are three risk preference behaviors that people and organizations can exhibit. These behaviors include risk seeking, risk neutrality, and risk aversion. Risk seekers crave the thrill of uncertainty and willingly sacrifice the security of a certain return for a chance at a higher potential pay off involving an uncertain return. This definition best describes Las Vegas gamblers and is hardly worth considering when discussing a strategy for public sector application. (Francis, 1980, pp. 551-570)

Risk neutral organizations and individuals are indifferent to increasing risk. They choose the option with the highest expected value regardless of the risks involved. This definition best describes people and organizations with either irresponsible attitudes towards resource management, unlimited funds, or potentially large diversified portfolios.

Governments as a whole may sometimes exhibit risk neutral behavior, particularly during times of war. However, as a general rule anyone who is forced to live within a budget or is held accountable for their actions can ill afford to be risk neutral. (Francis, 1980, pp. 551-570)

By far, most individuals and organizations that face the constraints of limited resources exhibit behavior which is risk adverse. The primary reason for risk adverse behavior is the asymmetrical aspect of benefits that occurs as a result of marginal resource changes. In general, the extra benefit received from an extra dollar of income decreases the higher one's income level becomes. Thus, the loss in benefit or utility for a given loss in resources is much greater than the gain in benefit or utility that can be achieved for an equal increase in resources. This explanation may sound rather esoteric, but the point is that risk averters will always value a certain outcome with a certain return higher than an uncertain outcome with the same expected return. (Francis, 1980, pp. 570-572)

We can use a common commodity bought by DFSC to illustrate this point. Since 1986, the average price of JP-5 has been about $25 per barrel with a standard deviation of about $5 per barrel. During the same period, the actual price fluctuated between a low of $16.43 per barrel and a high of $46.36 per barrel. Appendix H gives more specific price history detail. Suppose DFSC needed to buy JP-5 six months from now. The market consensus about the price in six months is expected to be the historical average, but general experience indicates that the price may fluctuate by as much as one standard deviation. If DFSC waits six months to buy on the spot market, the standard deviation price extremes of $20 per barrel and $30 per barrel are equally likely to occur, each with a 50 percent probability. At the same time, DFSC can buy a futures contract now for the market consensus price of $25 and fix its six month delivery price in advance. Which choice provides the greatest utility?

Assuming that DFSC faces a limited budget and scrutiny from its program sponsors, DFSC would be conservative in its actions and also risk adverse. Knowing DFSC's risk *preference*, we *can* standardize this example and make it universally applicable to more general situations. Utility can be described in terms of relative return and risk. Symbolically, DFSC is offered the following choice (Francis, 1980, pp. 570-581):

$$E(U)=f[E(r),\sigma]$$

versus

$$U=f[r,\sigma]$$

E(U) is the expected relative utility derived from the uncertain spot price that might be paid if DFSC waits six months. This expected utility is expressed as a function *f* of the expected return *E(r)*, and risk (*sigma*) of the expected return occurring. In this example, the risk (*sigma*) is defined as one standard deviation.

U is the actual relative utility derived from the certain futures price paid now. This actual utility is expressed as a function of the actual return *r* occurring, given the same level of risk (*sigma*) of one standard deviation.

The expected return *E(r)* is the specific probability of occurrence times the expected percent difference in price that would be realized by waiting six months to buy on the spot market. Symbolically, expected return is described as follows:

$$E(r)=p\left(\frac{CP_{now}-LP_{6mos}}{CP_{now}}\right)+(1-p)\left(\frac{CP_{now}-HP_{6mos}}{CP_{now}}\right)$$

In this equation, *p* equals the probability of a lower price *LP* occurring if DFSC waits six months and buys on the spot market. *CP* equals the certain futures contract price that can be paid now. In this example, *CP* equals $25. *LP* equals the lowest price that is expected if DFSC waits six months to buy on the spot market, given the anticipated level of risk. In this example, the anticipated level of risk is one standard deviation. Therefore, *LP* equals $20. The quantity expression *(1-p)* equals the probability of a higher price *HP* occurring if DFSC waits six months and buys on the spot market. *HP* equals the highest price that is expected if DFSC waits six months to buy on the spot market, again given the anticipated level of risk. Since the anticipated level of risk is still one standard deviation, *HP* equals $30.

The actual return r of the futures contract is simply the percent difference in price savings realized by buying a futures contract now and not waiting six months to buy on the spot market. Symbolically actual return is described as follows:

$$r=\left(\frac{AP_{6mos}-CP_{now}}{CP_{now}}\right)$$

In this equation, *AP* equals the actual price that would be paid in the spot market if DFSC waited six months.

We can use many utility functions to describe the behavior of risk adverse individuals and organizations. However, the quadratic utility function can be mathematically manipulated to show a distinct relationship between return and risk, where risk is defined by standard deviation. When utility is described as a function of return and risk, and risk is specifically defined by standard deviation, the quadratic utility function is a reasonable choice. Symbolically, it is described by the following (Francis, 1980, pp. 579-581):

$$U=f[r,\sigma]=r-br^2$$

In this equation, b is chosen so that the slope of the line associated with the last set of data observation points is close to zero. The constant b can take any value greater than zero, as long as one half of b is greater than r (Francis, 1980, pp. 579-581). In this example, b equals a value of three. In this form, the equation can be used to estimate the utility derived by paying the certain futures contract price now over the full spectrum of possible actual return outcomes.

Expected utility is symbolically described by the following (Francis, 1980, pp. 579-581):

$$E(U)=f[E(r),\sigma]=E(r-br^2)$$

This equation can also be rewritten as follows:

$$E(U)=p[(\frac{CP_{now}-LP_{6mos}}{CP_{now}})-b(\frac{CP_{now}-LP_{6mos}}{CP_{now}})^2]+(1-p)[(\frac{CP_{now}-HP_{6mos}}{CP_{now}})-b(\frac{CP_{now}-HP_{6mos}}{CP_{now}})^2]$$

Once in this later form, the equation can be used to estimate the utility derived by waiting six months and paying uncertain JP-5 prices over the full spectrum of possible expected return outcomes. Figure 21 compares *U* and *E(U)* for the JP-5 example just described. The top line represents the actual relative utility that will be achieved by buying at

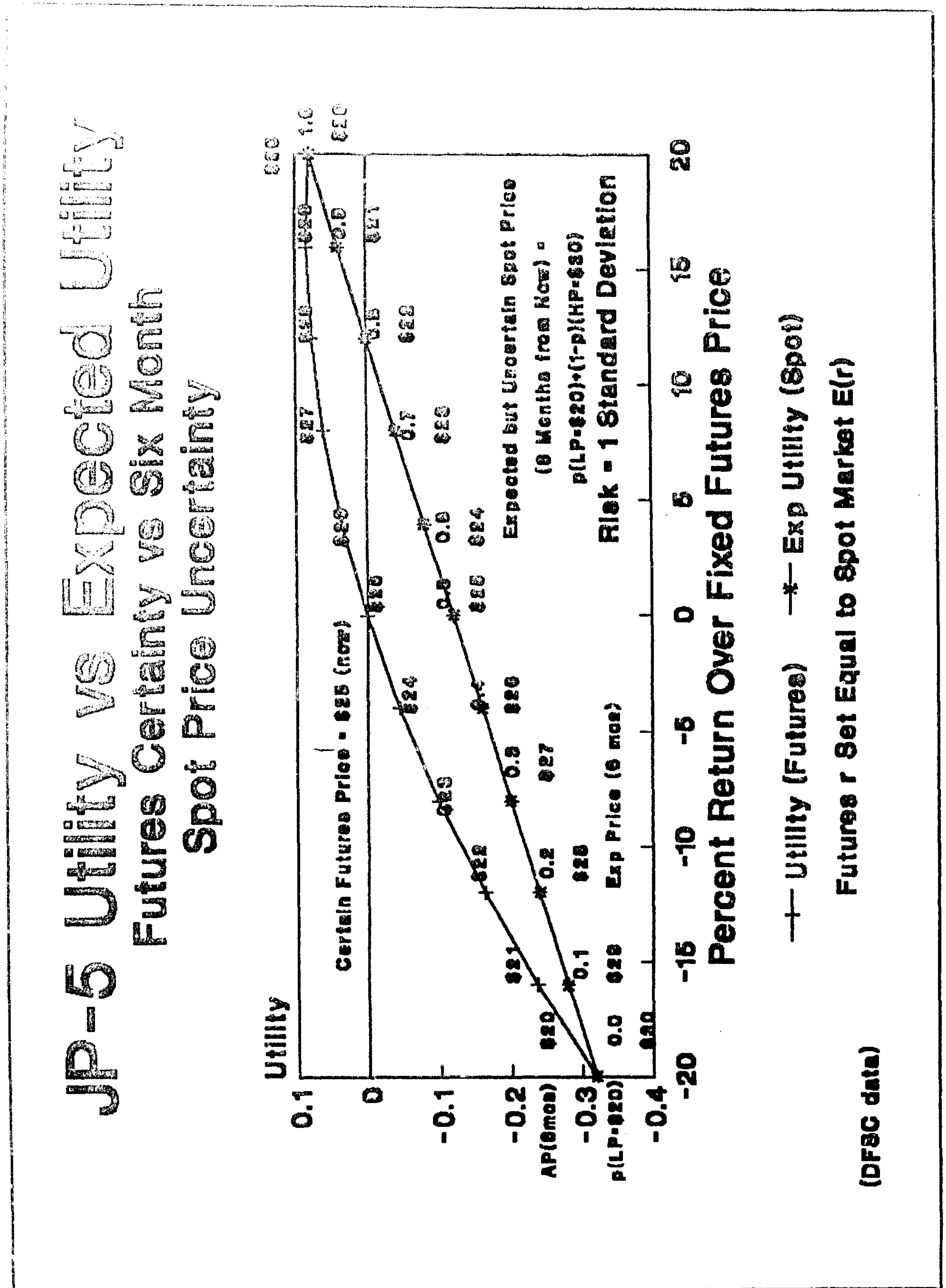


Figure 21 JP-5 Utility vs. Expected Utility

the futures contract price now. The prices associated with the top line represent the actual prices that would have to occur in six months to equal to the same return as expected under the conditions of waiting six months to buy on the spot market. Thus, a point on the top line shows the utility derived from the futures contract as a function of the actual future spot price.

For example, if DFSC buys a futures contract for $25 and the actual spot price becomes $24, the resulting utility is given by the point labeled *$24* on the top line. Similarly, if the actual spot price becomes $26, the resulting utility is given by the point labeled *$26* on the top line.

The bottom line represents the expected utility that might be derived by waiting six months to buy on the spot market. Both probability of occurrence *p(LP=$20)* and expected prices are given.

For example, if *p* equals 0.5, the expected spot price is $25 or 0.5($20)+0.5($30). The expected utility of buying on the spot market is given by the point labeled *0.5/$25* on the bottom line. Similarly, if *p* equals 0.4, the expected spot price is $26, or 0.4($20)+0.6($30). The expected utility is now given by the point labeled *0.4/$26* on the bottom line.

As can be seen, for equivalent levels of return, the futures buying strategy always has a higher utility than the waiting strategy. For the waiting strategy to be equal to buying the futures contract for $25 per barrel now, DFSC would have to expect at least a 12 percent greater return. This is the premium DFSC should be willing to pay for more perfect information about the future if it intended to wait six months and buy in the spot market. Another way of looking at it is that DFSC's expected price from waiting would have to drop below $22 per barrel before it would not want to buy the futures contract. At any expected price greater than $22 six months from now, DFSC would be better off by buying the $25 futures contract now.

For example, consider the $25 futures contract. The point labeled *$25* on the upper line shows the actual utility for this contract. The point labeled *0.5/$25* on the lower line shows the expected utility of buying on the spot market where *p* equals 0.5 and the expected price is $25. The difference in utility measures the value of certainty or risk aversion to DFSC. Alternatively, the points *$25* on the upper line and *0.8/$22* on the lower line have the same levels of utility. Thus, DFSC would have to believe that it could achieve at least a 12 percent greater return before it would not choose to buy the futures contract.

C. BASIC STRATEGY DESIGN

Another way of assessing futures trading performance is to determine if the strategy adequately satisfies trading objectives. There are basically only two objectives, to make profit or to protect value. In support of these objectives there are basically only two generic types of strategies, speculative strategies and hedging strategies. Speculative strategies are designed for the sole purpose of making profit. They are extremely risky endeavors that rely heavily on supposed superior market knowledge, rapid information response, and forecasting prowess to extract profits from the market. Because of their inherent risk and profit motivation objectives, speculative strategy designs are not recommended for public sector organizations with fiduciary responsibilities like DFSC. (Quick, 1992, pp. 44-48)

The other generic strategy type is hedging. Hedging is essentially a way to manage the risk of uncertainty. It seeks to protect the value of something that will be bought or sold in the future. It is intended to stabilize budgets and earnings over time. Hedging strategies can be used against any uncertain outcome that has the likelihood to affect the value of a commodity DFSC might want to protect. For example, purchases or sales can be hedged against price, interest rates, and even foreign currency exchange rates. (Quick, 1992, pp. 44-48)

The primary focus of any hedging strategy should be to improve management capabilities by providing predictable and improved financial performance. It minimizes the risks of making unpredictable and costly future mistakes. Hedging strategies should thus enhance management and improve performance in addition to reducing risk.

The question that arises from this discussion is what should be the primary financial elements of basic hedging strategy design. First and foremost, it should provide price certainty. As discussed many times throughout this thesis, futures trading by itself does this. Second, it should consistently provide greater intrinsic benefit or utility than can be achieved by buying on the spot market for the same level of expected return. From the discussion on utility, futures trading does this as well. Third, it should minimize disutility from future events, a concept discussed below. Finally, it should provide real financial savings.

In order to discuss the problems of disutility, reconsider the previous graph as presented in Figure 21. As can be seen by this graph, when the actual price in six months *AP(6mos)* falls below $25, the utility associated with the futures contract quickly diminishes. Once DFSC buys a futures contract it can no longer participate in the price savings that occur when the actual spot market price drops. Again, the loss in benefit or utility for a given loss in resources is much greater than the gain in benefit or utility that can be achieved for an equal increase in resources. Since one significant drop in price may far outweigh the utility gained from many price increases, futures contracts by themselves could not provide an adequate hedging strategy, particularly for DFSC. However, this disutility aspect can be corrected with the use of an options put contract.

Recall that a put contract is the right but not the obligation to sell the underlying futures contract for a predetermined strike price in the future. This right is given in exchange for the price of a premium paid to the options seller in advance (NYMEX, September 1992, pp. 9-11). In the JP-5 example, the futures contract could have been balanced by purchasing a put with a strike price of $25. This $25 put would have allowed DFSC to sell the futures contract for $25 regardless of its subsequent price. This options feature, would limit realizable losses to the cost of the premium paid on the put option plus any transactions costs.

Options price premiums are based largely on measures of risk associated with price volatility, time until expiration, and interest rates. Generally they only result in a few pennies per barrel but may be much higher depending upon the perceived risk (NYMEX, September 1992, pp. 1-4). Transaction costs depend upon volume of trade and the type of broker used, but generally run about one or two pennies per barrel.[16] Both of these costs tend to be substantially lower than the potential losses that could occur due to price fluctuations.

D. A WORKABLE STRATEGY

To discuss real financial savings it is probably best to look at a couple of bona fide strategies. The strategies

[16]Interview between M. Bertoncini, Associate Broker, Mercafe Inc., New York, NY, and the researcher, 27 October 1993.

discussed here are variations of a six month lift and roll plan described by NYMEX. (NYMEX, 1993)

Semi-annually, futures contracts for the six succeeding months would be bought on the first trading day of the semi-annual period. Futures contract quantities would exactly offset actual physical contract deliveries scheduled for each month during the period. Each successive futures contract would be sold during its expiration month on the first trading day closest to the tenth of the month. This permits the closing or lifting of open positions while avoiding the extreme price fluctuations common on the last day of market trading and expiration. (NYMEX, 1993)

When the futures contracts for each of the six months are all lifted, positions are reevaluated and then rolled into the next six months with the purchase of new futures contracts. This lift and roll strategy provides the optimum advantage of reducing price volatility. At the same time, it allows a hedger like DFSC an opportunity to periodically reevaluate positions, market conditions, and strategies before committing to each successive six month period. (NYMEX, 1993)

Commodities actually required are rarely traded on any regulated exchange. Therefore, for any hedging strategy to work properly there must first be a reasonable correlation between the price behavior of the physical commodity we actually wish to buy or sell, and the price behavior of a futures commodity that we can actually trade on a regulated exchange. This correlation, or rather the lack of correlation is called basis risk. Basis risk is the difference between the price of the underlying commodity being hedged and the price of the futures commodity actually traded on a regulated exchange. (NYMEX, 1993)

Most of the commodities managed by DFSC, like JP-5, are not specifically traded on any regulated exchange. However, commodities that are traded have a close enough correlation to be useful. Closely correlated commodities could act as surrogates for each other. Savings from one could be transferred to the other for the purpose of hedging.

As stated in Chapter II, DFSC currently uses commercial jet fuel to establish the economic escalator for its physical contracts. Figure 22 shows that the correlation between JP-5 and commercial jet fuel is about 89.5 percent. Unfortunately, commercial jet fuel is not a traded commodity and therefore is not useful for the purposes of hedging operations. Figure 23 shows that the correlation between JP-5 and West Texas Intermediate (WTI), a heavily traded futures commodity, is about 82.1 to 84.3 percent. This is not substantially different from commercial jet fuel, but vastly more useful for the purposes of hedging. If DFSC wanted to totally eliminate basis risk while trading in the futures market, it could establish WTI as the economic escalator index for its physical contracts. Not only would this eliminate all basis risk for DFSC's hedging operations, but it would do so without

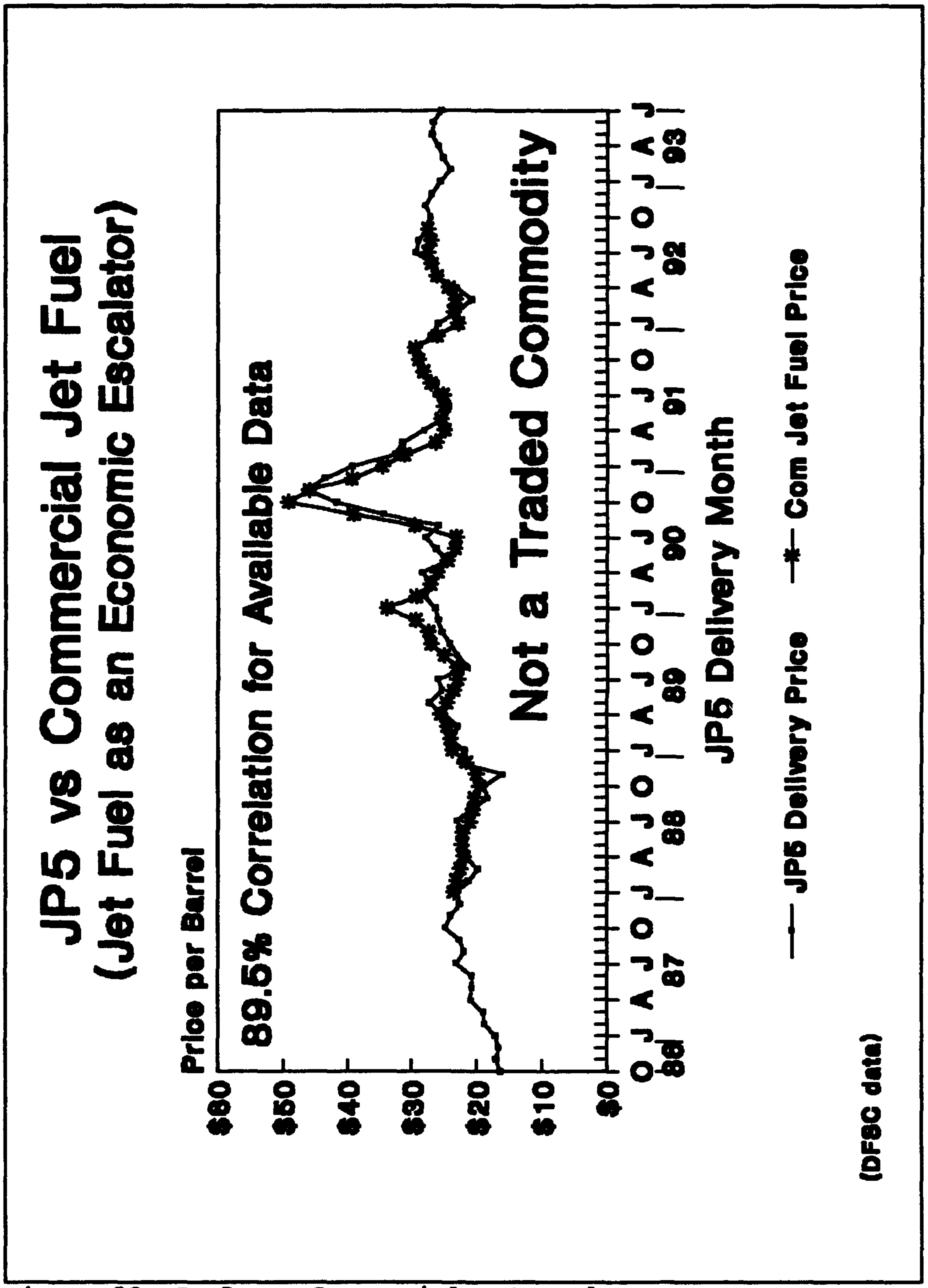


Figure 22 JP-5 vs. Commercial Jet Fuel

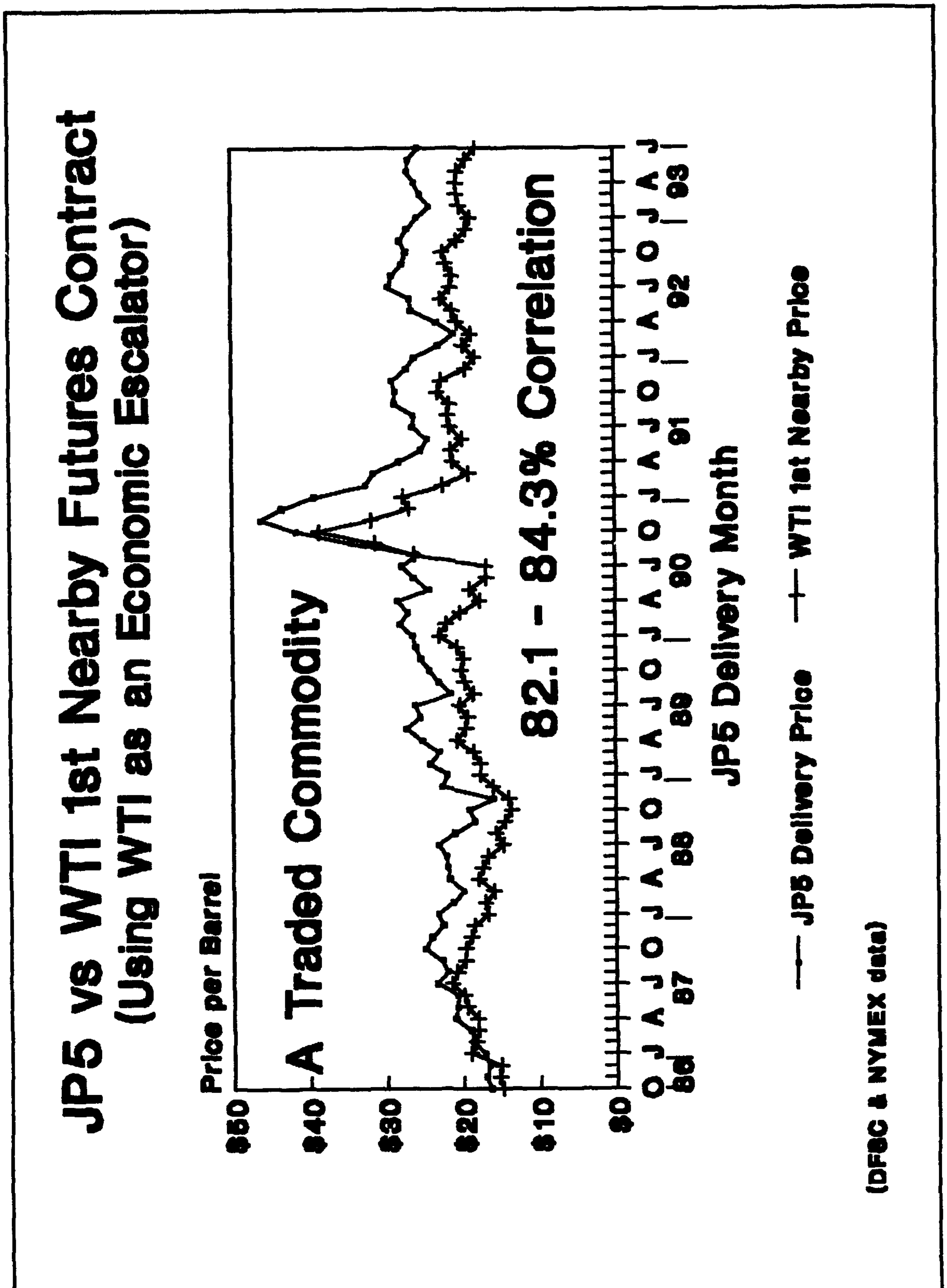


Figure 23 JP-5 vs. WTI

shifting appreciable risk onto suppliers. It turns out that the correlation between WTI and commercial jet fuel is very high, about 94.7 percent as seen in Figure 24.

Using WTI as a surrogate commodity, the maximum risk of the six month lift and roll hedging strategy can be calculated. Suppose the hedge was purposely fixed at the height of uncertainty during Desert Shield, about October of 1990. This would fix the futures price at an historically high level and would preclude DFSC from participating in the huge savings that occurred as the market price plunged during the next six months. Figure 25 shows that even with this naive strategy, DFSC would have essentially broken even. With trading commissions factored in, DFSC would have lost only $.02 per barrel per year, essentially just the commission charge itself.

However given DFSC's market analysis abilities, this is an extremely unlikely result. Because of obvious market events, it would have been extremely unlikely for DFSC to have established a hedge at the highest price. Ignoring this six month period, the naive lift and roll strategy would have saved the Government about $104.6 million per year.

However, there is a better way to reduce the downside risk. The top line in Figure 26 shows that using the historical price average and a risk standard deviation equal to one, DFSC would have expected significant disutility if it were hedged at the historic average and the price were to

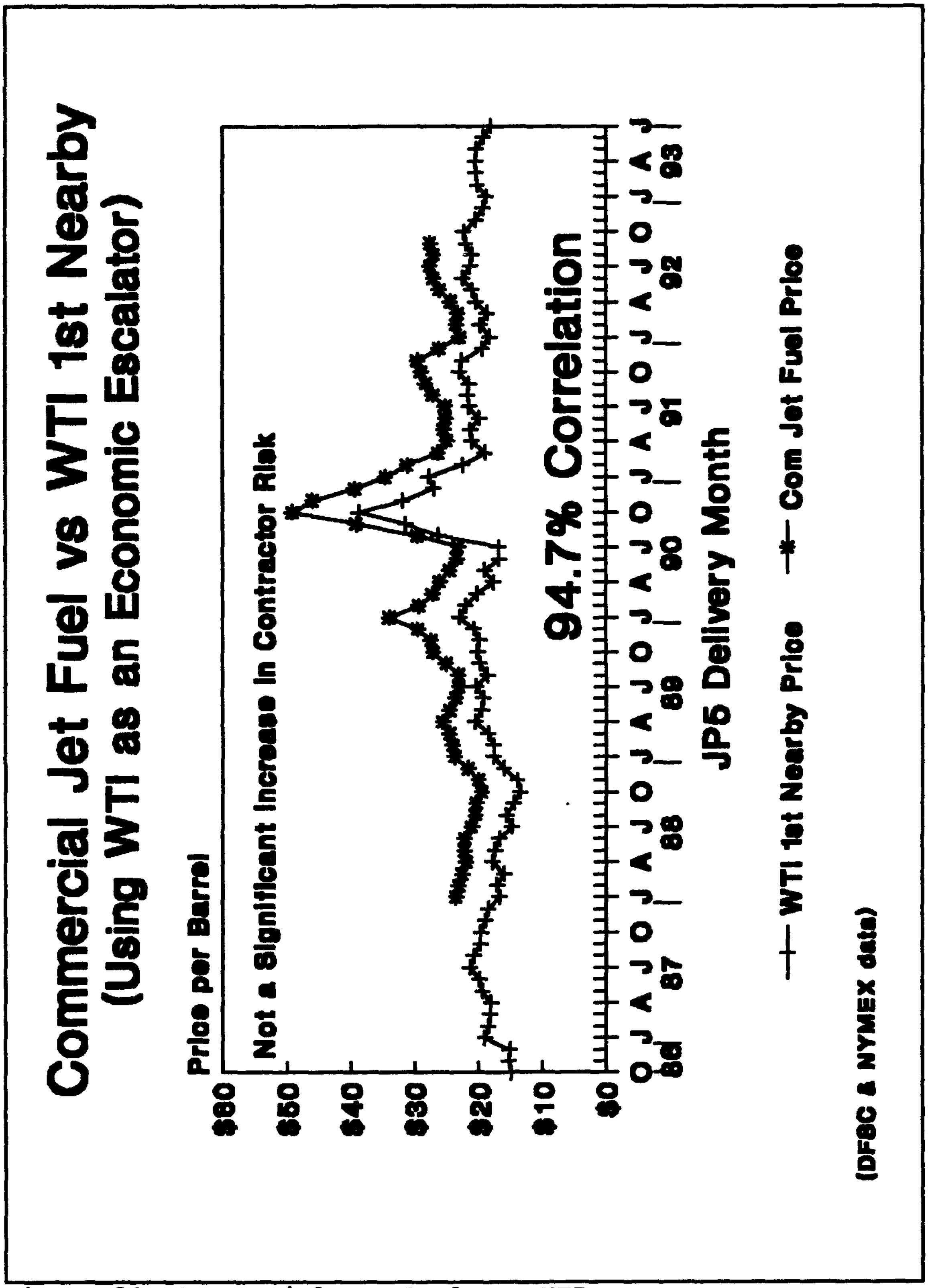


Figure 24 Commercial Jet Fuel vs. WTI

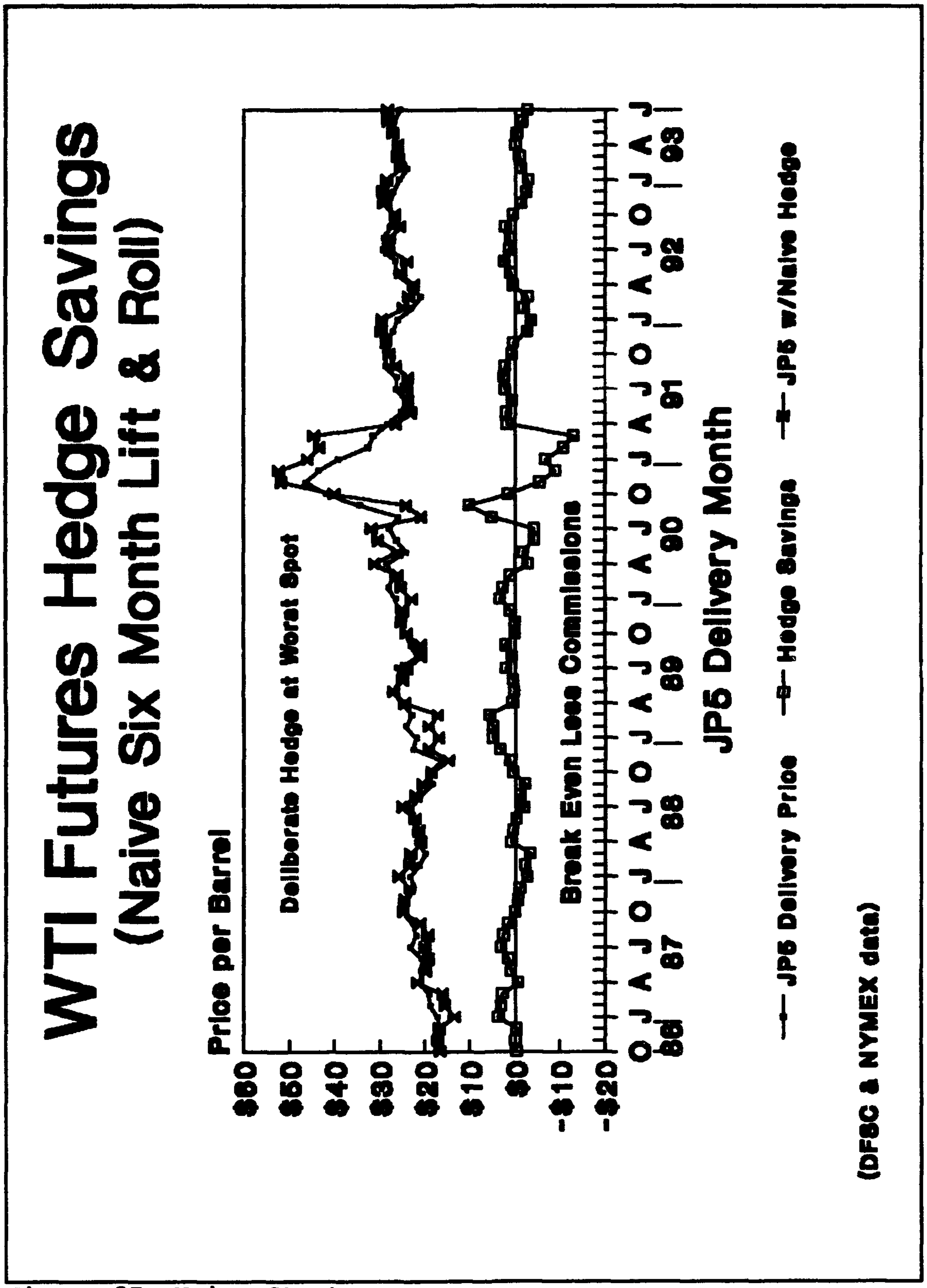


Figure 25 Naive Strategy

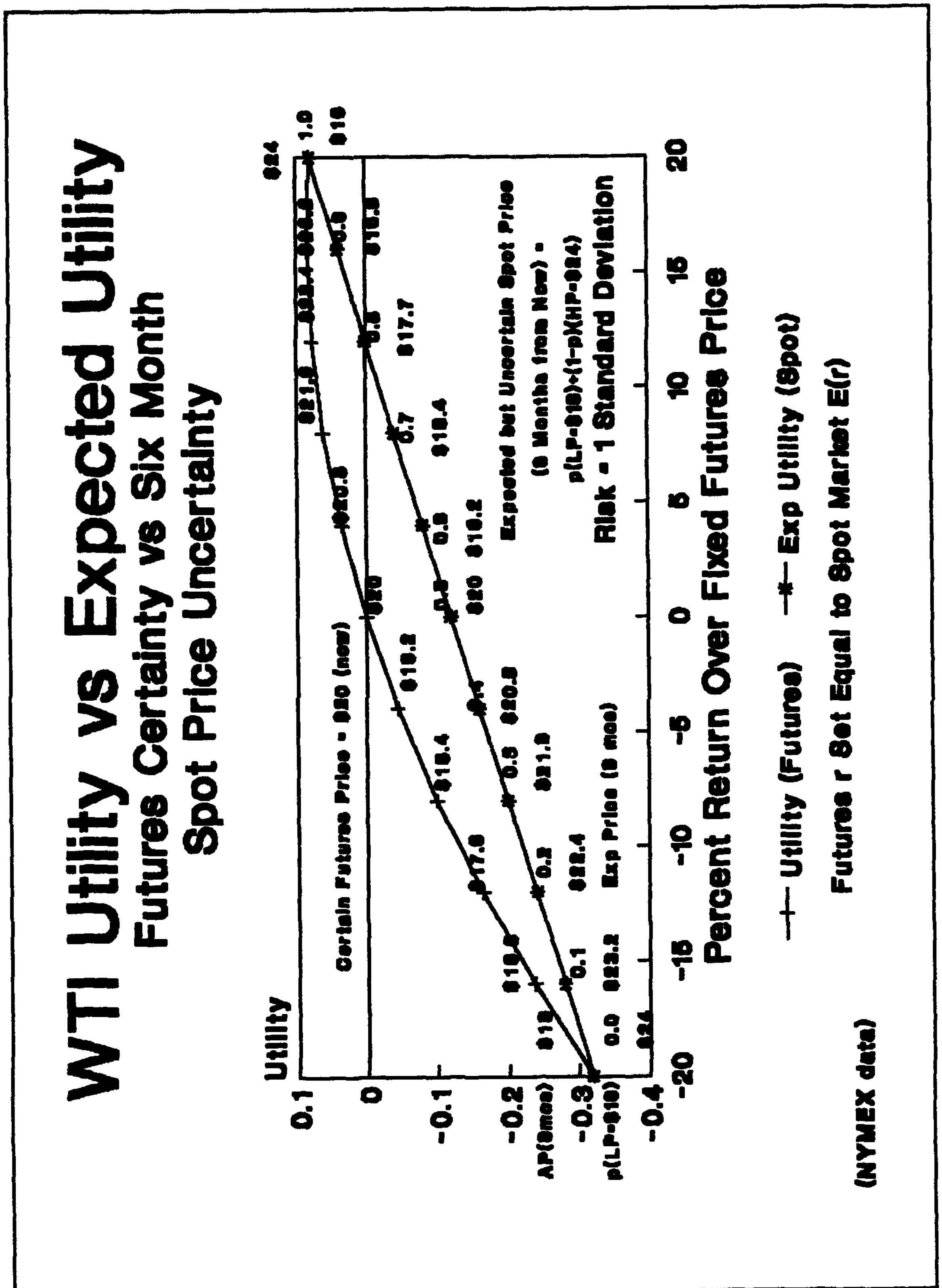


Figure 26 WTI Utility vs. Expected Utility

drop below $20 per barrel. To mitigate this disutility DFSC should establish a $20 options put trigger. In other words, if the actual price of the futures contract ever went above $20, eventually market pressures would drive the price back down. Anticipating this market pressure, DFSC should buy a put contract at whatever strike price is closest to the underlying futures price above $20. This would protect against the possibility of a subsequent market correction back toward or below the historic price average.

Figure 27 shows that this simple but more complete strategy would have saved the Government in excess of $77.7 million per year.

E. SUMMARY

Futures trading can be thought of as a choice between an outcome that is certain and one that is not. The abstract concept of utility can be used to show that for equal levels of expected return, normally risk adverse organizations and individuals would always prefer the certain outcome provided by futures trading over the uncertain future outcome of buying in the spot market. Futures trading strategies generically belong to two different categories that fulfill different trading objectives. However, a basic hedging strategy should provide price certainty, higher utility or intrinsic benefit that is consistently better than buying in the spot market, a minimization of disutility from actual future price changes,

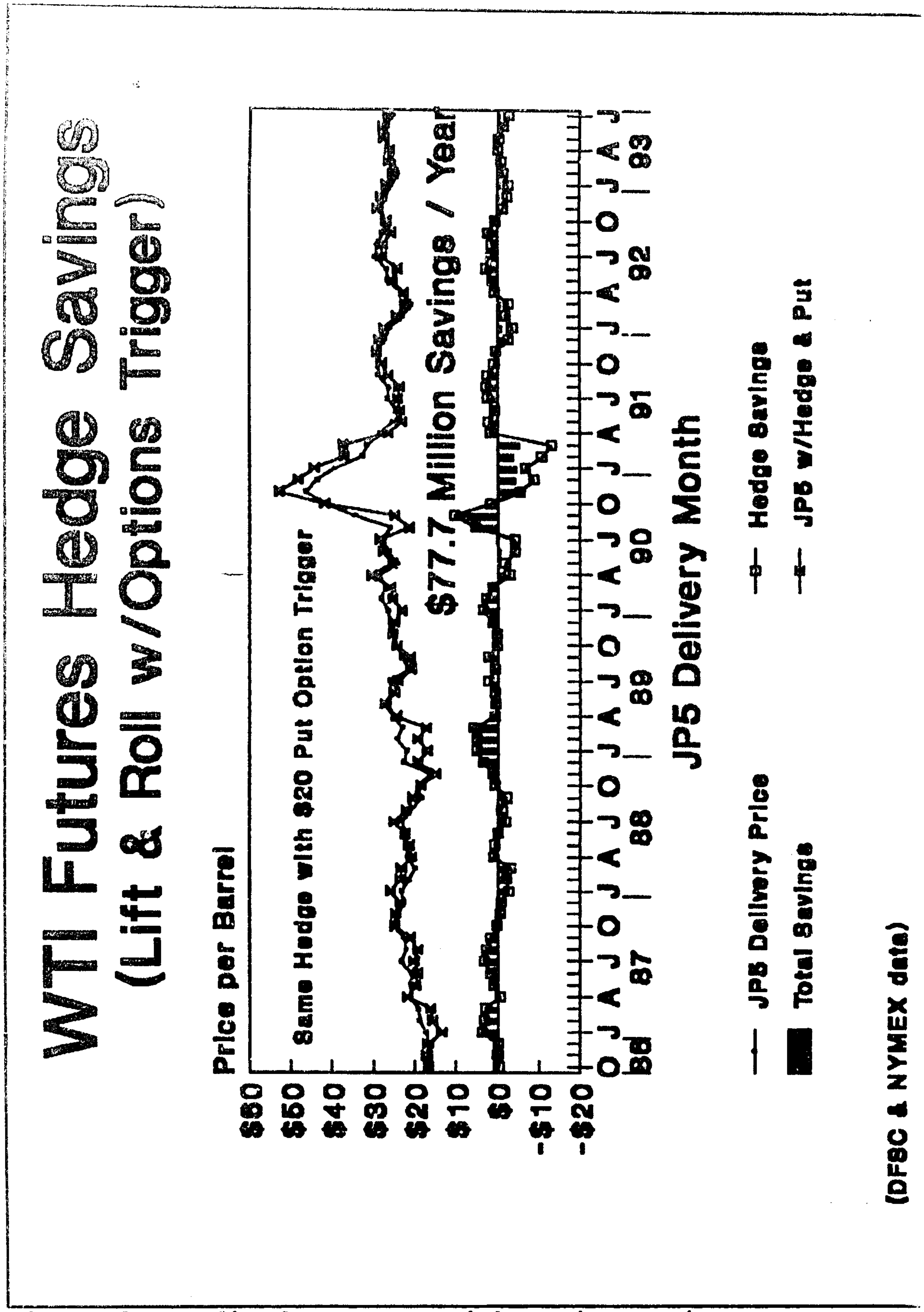


Figure 27 Refined Strategy with Options Trigger

and real financial savings. Using a basic lift and roll strategy with an options put trigger completely meets these trading objectives.

VI. ANALYSIS OF STRATEGIC FIT

A. CHAPTER OVERVIEW

This chapter examines the idea of futures trading in terms of strategic fit. It describes the importance of strategic fit, and provides a strategic planning model to shows how one might determine strategic fit within any public sector environment. This model is then used to determine whether futures trading has a particular strategic fit within DFSC. The chapter also examines some of the barriers to futures trading implementation, and presents suggestions for overcoming these barriers, including a proposal for legislative language to authorize futures trading.

B. IMPORTANCE OF STRATEGIC FIT

A primary precondition for any strategy to be viable and effective, is that it must also be relevant to the specific nature and of its environment. This precondition is called strategic fit. According to Tom Peters, famed lecturer, consultant, and thought provoking author of numerous bestselling books on business management, the linkage between strategy and environment is of critical importance. Many strategies fail from inception because they do not recognize the environments in which they are destined to operate. Many more fail because they remain inflexible and are neither adaptive, nor executable with regard to recognizable conditions that occur within the strategic environment. These environmental factors, if left unaddressed, become catalysts of failure. They may pe-exist or may manifest themselves as environments simply evolve. (Peters and Waterman, 1982, pp. 3-8)

> Once upon a time, the earth was stalked by dinosaurs, monstrous reptiles who ranged up to sixty feet in height and weighed as much as 100 tons. Although we don't know precisely when the colossal lizards lived, they left footprints instead of tire tracks wherever they went, so we are reasonably certain that they predate the invention of the company car. The question is why they died out. The most likely explanation is that gradual or sudden changes occurred in the environment, and that in spite of their size and strength, dinosaurs lacked the intelligence to adapt to those changes. (Hochheiser, 1987, p. 62)

The plight of the dinosaurs, and their ultimate extinction, illustrates that events in nature may have a remarkable similarity to the behavior of organizations, particularly large lumbering bureaucratic organizations like those found in Government and major corporations.

> Andrew Pettigrew, a British researcher, studied the politics of strategic decision making and was fascinated by the inertial properties of organizations. He showed that companies often hold on to flagrantly faulty assumptions about their world for as long as a decade, despite overwhelming evidence that the world has changed and they probably should too. (Peters and Waterman, 1992, pp. 7-8)

Andrew Pettigrew's findings, however, should not be too surprising. It merely confirms and validates the scientific work done several hundred years earlier by another famous

British researcher, Sir Isaac Newton. (Hochheiser, 1987, p. 93)

Indeed, Newton's first law is as descriptive of organizational behavior as it is of the natural world for which it was intended.

> Newton's first law states that an object at rest remains at rest unless enough force is applied to get it moving. Alternatively, an object moving along at a certain rate can be slowed down or accelerated only if enough force is applied. In each case, the required force is proportional to the mass of the object. (Hochheiser, 1987, p. 93)

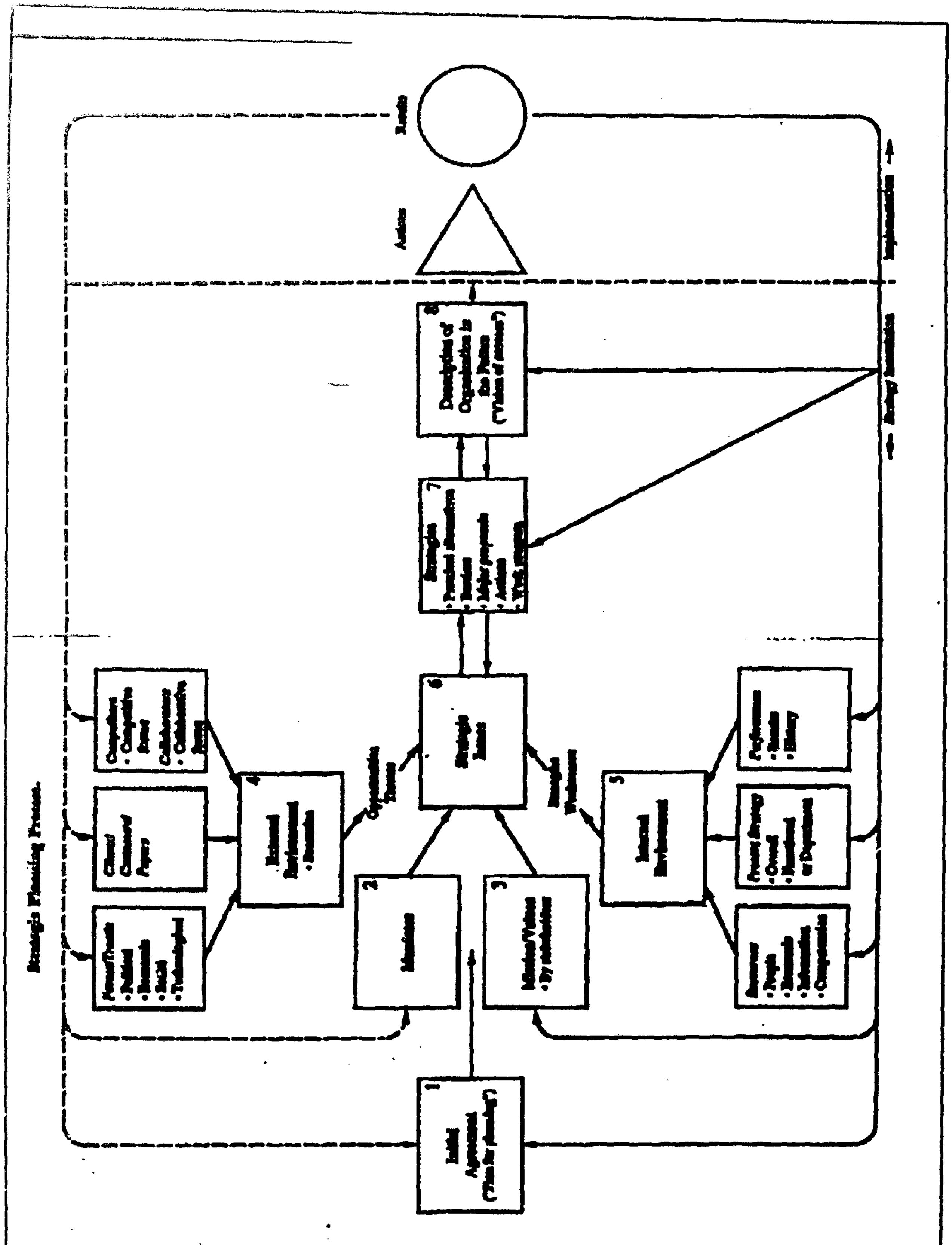
While the bureaucracies of organizations tend to slow down their strategic reflexes to environmental changes, the problems of achieving strategic fit may be even more basic. For most organizations the act of merely identifying and recognizing the specific nature and characteristics of the strategic environment is an extremely difficult task, particularly if the strategic environment is the driving force behind strategy design. Private firms tend to evaluate strategies based upon measurable indicators like profitability and market share, but also devote enormous resources to try to identify the strategic environment and to ensure that their strategies fit the circumstances. Yet sometimes even after tremendous effort, some firms can not fully achieve strategic fit, because they can not adequately identify nor define their strategic environment. (Peters and Waterman, 1982, pp. 3-8)

In the public sector, this idea of strategic fit is further complicated by the need to address a broad range of difficult and often conflicting public policy issues. These issues may range from the purely economic to the purely political, but the underlying reality is that the public sector is primarily a political arena. Decisions are rarely made on the basis of economic merits alone, but tend to be strongly influenced by politics, sometimes overriding economic concerns. (Osborne and Gaebler, 1992, pp. 20-22)

Judging the economic merits of futures trading, as was done in Chapter V, is therefore only one step in determining strategic fit, and only a small part of resolving the real issue. The question is whether futures trading is a viable or even wise thing for a Government entity to do. In order to better answer this question, we must examine the idea more broadly in terms of its public sector environment and politics involved.

C. DETERMINING STRATEGIC FIT

The question is, how can one begin to objectively determine the strategic fit of an idea in a public sector environment when measurable criteria like profitability and market share do not normally apply, and seemingly unmeasurable aspects like politics can easily override rational ideas based upon economic merits. John Bryson, associate director of the Strategic Management Research Center at the University of Minnesota, has developed a model that can do just that. Bryson's model, as shown in Figure 28, was designed primarily



(Bryson, 1988, p. 50-51)

Figure 28 Strategic Planning Process Model

BEST AVAILABLE COPY

to help improve the strategic planning processes within both public and nonprofit organizations, but several of its procedures can also be used to determine strategic fit. The model addresses the many aspects of strategy development that are unique to public sector environments. Bryson saw many weaknesses in the methods of strategic planning employed by corporations when applied to public sector organizations. In particular, the differences in organizational goals, political environments, and stakeholder concerns were not well addressed in the corporate models. (Bryson, 1988, pp. xxiii-48)

In contrast, Bryson's model provides a methodical approach for uncovering and acting upon strategic issues that relate to the public sector environment. Bryson defines a strategic issue as being any fundamental policy question that may affect an organization's mission, mandate, values, level or mix of products or services, clients, costs, financing, or management. Strategic issues are identified and strategic fit is determined in each of the first five steps of the model. Since each step represents an important element of the public sector environment, each strategic issue ultimately reflects the organizational and motivational differences inherent to that environment. Strategies are developed as ways of resolving the strategic issues uncovered, and are then compared against practical alternatives. Strategies are evaluated in terms of their ability to satisfy each factor impacting on a particular strategic issue. Those strategies with the best strategic fit are then incorporated into the organization's business plans or vision of the future for eventual implementation. (Bryson, 1988, pp. 46-70)

Thus according to Bryson's model, the strategy of trading in the futures market should meet the following conditions:

- It should first be seen as a practical alternative for resolving an identifiable strategic issue that emerges through examination of the relevant public sector environment.

- It should be evaluated in terms of its ability to satisfy those factors that impact on a particular strategic issue.

- It should be compared with other alternatives.

- Finally if thought to be the best alternative, it should be developed further for inclusion in DFSC's business plans, or vision of the future for eventual implementation.

From previous discussion, radical movements in oil market prices have been a problem for DFSC since 1973. However since the fall of the Berlin Wall, the problem has grown progressively worse. By Bryson's definition, this problem is a strategic issue, because it has the potential to impact one or more of DFSC's missions, mandates, values, level or mix of products or services, clients, costs, financing, or management. From this definition and the economic arguments presented in Chapter V, the strategy of trading in the futures market is at least one alternative for resolving this identifiable strategic issue. This strategy should be compared with other alternatives, such as those presented at the end of Chapter II, and then evaluated in terms of its ability to satisfy the factors that impact on this strategic issue. If futures trading is then considered to be the best alternative, it should be developed further.

While the other alternatives mentioned in Chapter II require further research beyond the scope of this thesis, the strategy of futures trading can easily be evaluated for strategic fit by using the first five steps of Bryson's model.

1. Initial Agreement

According to Bryson, prior to strategy development, an organization should reevaluate itself. By the same token, there must first be some initial agreement that a reevaluation even needs to occur. This agreement usually results in key decision makers or opinion leaders lending their support and commitment to the reevaluation process, devoting essential resources and empowering people within the organization to proceed. (Bryson, 1988, pp. 48-49)

Much of this initial agreement has a great deal to do with timing. According to Mark McCormack, author of *What they Don't Teach You at Harvard Business School*,

> Many ideas fail not because they are bad ideas, not because they are poorly executed, but because the timing is not correct. (McCormack, 1984, p. 94)

Futures trading is only one of the latest in a long string of ideas relating to the general topic of acquisition reform. Unfortunately, agreement over acquisition reform has never been easy to come by. In fact, complaints over inefficient procurement practices are not particularly new. During the Kennedy Administration over 30 years ago, Robert S. McNamara, then Secretary of Defense, noted that a major cause of cost overruns in Defense programs was,

> ...an over-reliance on contracting procedures which did not provide incentives to reduce cost. (Robinson, Mills, and Bower, 1974, p. 3)

Bob Stone, former Assistant Secretary of Defense (Installations) once gave a frustratingly clear description of the depth of procurement problems when he estimated that,

> ...a third of the Defense budget goes into the friction of following bad regulations.... This kind of rule has two costs. One is, we've got people wasting time. But the biggest cost - and the reason I say it's a third of the Defense budget - is it's a message broadcast to everybody that works around this stuff that it's a crazy outfit. You're dumb. We don't trust you. Don't try to apply your common sense.... [A typical steam trap costing $100] leaks $50 a week worth of steam. The lesson is, when it leaks, replace it quick. But it takes a year to replace it, because we have a [procurement] system that wants to make sure we get the very best buy on this $100 item, and maybe by waiting a year we can buy the item for two dollars less. In the meantime, we've lost $3,000 worth of steam. (Osborne and Gaebler, 1992, pp. 8-10)

In March of 1986, a Blue Ribbon Commission on Defense Management, established by President Reagan and headed by David Packard, called for sweeping changes to the acquisition system, "...citing structural problems 'far costlier' than the well-publicized coffee pots and toilet seats." (Gansler, 1989, p. 323)

However nearly ten years later, the DoD Advisory Panel on Streamlining and Codifying Acquisition Law, commonly referred to as the Section 800 Panel, spent over 16 months revisiting many of the same issues previously covered by the Packard Commission report including many of the same suggestions made but never implemented. This recent January 1993 report produced over 1,800 pages of recommendations on over 600 acquisition statutes affecting DoD practices. Citing many changes in the operating environments that have occurred since the end of the Cold War, the Section 800 Panel again called for sweeping changes to the acquisition system and focused on recommendations designed to:

- streamline the Defense acquisition process and adopt commercial practices wherever possible,
- codify and simplify relevant acquisition laws,
- eliminate unnecessary laws that impede buyer/seller relationships or alter accepted commercial accounting or business practices,
- ensure continued financial and ethical integrity of Defense procurement programs,
- and protect the best interests of DoD. (DoD Advisory Panel, 1993, pp. v-8)

Specific recommendations relating to fuel and energy would grant DFSC relief from certain contracting procedures. Primarily, it would allow DFSC to,

> ... sell petroleum, when in the public interest would encourage economy and efficiency within fuel management and acquisition.... (Acquisition Law Advisory Panel, 1993, p. 3-303)

Current procedures under Title 10 of the United States Code, Section 2404, allow DFSC to trade unwanted fuels in exchange for fuels more desirable (DFSC, 1992, p. 19). However the logistical problems in finding someone, usually a commercial vendor, willing to take exact exchange of a non commercial product designed strictly for military use, makes this procedure largely impractical.[17]

According to the Section 800 Panel this particular change in law would,

> ...serve a valid purpose by providing DoD with the flexibility necessary to adapt its petroleum purchases to market conditions. This authority is particularly important for fuel purchases because of the critical role of that product in military readiness. The use of this authority during Operation Desert Shield clearly demonstrates that fact. (Acquisition Law Advisory Panel, 1993, p. 3-303)

This particular recommendation is mentioned because similar rationale could be used to suggest and promote futures trading strategies.

In a follow-up report to the Section 800 Panel, the Defense Science Board (DSB) Task Force on Defense Acquisition Reform for the Under Secretary of Defense (Acquisition), made broad recommendations for, "...proceeding with radical change to the current [procurement] process...," (Hermann, 1993). Supporting the recommendations of the Section 800 Panel, the DSB Task Force placed great emphasis on the idea of adopting commercial practices, and breaking down barriers and offensive processes that interfere with those commercial practices. (DSB, 1993, i-16)

---

[17]Interview between C. Lee, Director of Market Research and Analysis, Defense Fuel Supply Center, Alexandria, VA, and the researcher, 23 August 1993.

While the general topic of acquisition reform has been discussed ad nauseam for many years without much result, Mark McCormack's theory might suggest that the timing may finally be right for true agreement on the need to proceed with it. The major change in circumstances is that today the Commander in Chief of the Armed Forces, President Bill Clinton, along with Vice President Al Gore, have become directly involved in the process. Together, they have given not only support, commitment, and resources to the idea of reform, but also their leadership and direction to empower people within the Government to proceed with it.

The capstone document of this new effort is the September 7, 1993 National Performance Review report to the President, written by Vice President Al Gore and entitled, *From Red Tape to Results, Creating a Government that Works Better and Costs Less*. Although the report speaks to all Government programs, it also lists 20 broadly defined recommendations for "reinventing" the procurement process. The thrust of these recommendations in the contracting arena, would be to encourage procurement innovation and move away from rigid rules toward a concept of broad guiding principles. In fact, one of the chapters within the full report is entitled, *Using Market Mechanisms to Solve Problems*. Although this chapter does not specifically address futures trading, clearly the intent was to encourage innovative market based strategies in all areas of reform. (Gore, 1993, pp. i-166)

The assessment here is that there is probably greater agreement now on the need for reexamining Government processes, than probably any time since before the Civil War. The timing for new and innovative market based strategies is ripe. As the Nation's leadership has moved toward restructuring and redefining Government, the resulting climate of broad based reform clearly makes it possible to seriously consider, and probably for the first time, non-traditional market based strategies like futures trading.

2. Mandates

According to Bryson, after achieving initial agreement on the need for reexamination, an organization must clarify its mandates. Bryson defines mandates as both the formal and informal directed requirements confronting an organization. These are the specific things that an organization must either do or avoid doing in order to comply with external direction. (Bryson, 1988, p. 49)

Chapter II discussed many of the procurement handicaps that DFSC faces. Most of the handicaps mentioned result as a matter of complying with Government mandates. Socio-economic programs, small business set-asides, and acquisition lead-time requirements all have their basis in law or regulation, and all hamper effectiveness and efficiency in DFSC's ability to react to oil market price instability.

There is great concern that the sheer number of mandates causes significant problems. As explained by Chris Lee the Director of Market Research and Analysis at DFSC, when compared with the commercial sector, Government contracting is so constrained by law and regulation that it affords very little creative latitude in contract administration or enforcement. This lack of latitude forces the Contracting Officer into significantly greater reliance on the formal contracting document, forcing him to anticipate potentially unpredictable problems and remedies long before they ever occur. Left with few options but the formal contract as the primary governing structure, the Government must generally enforce the contract according to its literal meaning. (Lee, 1990, p. 32)

Commercial firms tend to view contracting as a sort of marriage, and try to contract with firms of known reputation. They often make informal adjustments that cope with circumstances not specifically addressed in the formal contract. The Government, on the other hand, tries to ensure that every possible contingency is covered in a sort of prenuptial agreement. (Lee, 1990, p. 392). Unfortunately, petroleum markets are extremely volatile, and it is nearly impossible to write formal contracts which correctly anticipate all of the possible future contingencies and provide for every appropriate contractual remedy. (Lee, 1989, p. 27)

Many of these mandate concerns are real, but some are a matter of perception. Often there is a tremendous difference between a mandate's intention and a mandate's interpretation. As Bryson explains,

> It may not be surprising, then, that many organizations make one or both of two fundamental mistakes. Either they believe that they are more tightly constrained in their actions than they are; or they assume that if they are not explicitly told to do something, they are not allowed to do it. (Bryson, 1988, p. 49)

Currently, there is no procurement guidance anywhere in Federal statutes or regulations relating to futures trading. There is also no clear mandate against it (Stanley, 1993). There is a DoD policy against the practice of speculation (DFSC, 1993), however the futures trading strategy under consideration has nothing to do with speculation. The true intent of the futures trading strategy under consideration is to hedge against market price volatility. The purpose is to mitigate the risk consequences associated with actual physical quantities under firm contract, not to speculate with uncovered futures positions for profit making.

There are other concerns of interpretation as well. Currently, there is no appropriation specifically authorizing DFSC to spend money on futures trading. According to United States Code 31, Section 1301 (a),

> Appropriations shall be applied only to the objects for which the appropriations were made except as otherwise provided by law. (Duval, 1993, p. 5)

However under the "Necessary Expense Doctrine", each spending agency has reasonable discretion to implement their object of appropriation any way they desire. The question is, would futures trading be considered a necessary expense without specific clarification. The answer is, it probably depends on interpretation. Under the Necessary Expense Doctrine, a justified expense must meet three tests:

- it must bear a logical relationship to the appropriation charged,
- it must not be prohibited by law,
- and it must not be within the scope of some other appropriation. (Duval, 1993, p. 5)

While it appears as if futures trading could meet the three tests, the General Accounting Office has never specifically addressed the issue of futures trading and stresses,

> We have dealt with the concept of 'Necessary Expense' in a vast number of decisions over the decades. If one lesson emerges, it is that the concept is a relative one: it is measured not by reference to an expenditure in a vacuum, but by assessing the relationship of the expenditure to the specific appropriation to be charged or, in the case of several programs funded by a lump-sum appropriation, to the specific program to be served. It should be thus apparent that an item that can be justified under one program or appropriation might be entirely inappropriate under another, depending on the circumstances and statutory authorities involved.... When we review an expenditure with reference to its availability for the purpose at issue, the question is not whether we would have exercised that discretion in the same manner. Rather, the question is whether the expenditure falls within the agency's legitimate range of discretion, or whether its relationship to an authorized purpose or function is so attenuated as to take it beyond the range. (Duval, 1993, p. 5)

While the effect of this particular mandate owes itself to interpretation, there are other mandates that appear beyond interpretation. The Defense Fuel Supply Center is required to meet specific unit cost goals under the Defense Business Operations Fund (DBOF) Program (Duval, 1993, p. 4). Created in October of 1991, DBOF requires activities to identify and allocate the full annual costs of their operations to the goods and services produced (Chapin, 1993, p.4). As stated in Chapter II, product costs make up about 85 percent of DFSC's operating costs, and fuel prices to customers are standardized for the entire year. Therefore, volatility in market oil prices makes meeting DBOF goals nearly impossible to predict or consistently achieve.

In the past, DFSC has easily obtained supplemental appropriation funding whenever oil prices dictated, but a new mandate under the National Defense Authorization Act of 1994 states that,

> It is the sense of Congress that the Secretary of Defense...should seek personnel reductions and other management and administrative savings that, by September 30, 1998, will achieve at least a 25 percent reduction in Defense acquisition management costs below the costs of Defense acquisition management during fiscal year 1993. (National Defense Authorization Act, 1993, sec. 834)

The assessment here is that there are no clear mandates for or against futures trading. The mandates that are in place, are in fact, highly interpretive and subjective. However, there are several mandates that create operational problems during periods of market oil price volatility.

3. Mission/Values

According to Bryson, an organization must also clarify its mission and values. An *organization's* mission and values in tandem with its mandates provide the social justification for its existence. An organization must always be viewed as a means to an end, not an end in and of itself. An organization must continually justify its existence in terms of how well it can meet the particular needs of its various stakeholders. (Bryson, 1988, p. 49-53)

The basic mission of DFSC, as stated in Chapter II, is to buy and manage most of the fuel requirements for DoD as well as other Federal and Civil agencies. Yet in this mission, DFSC has multiple responsibilities. It has a fiduciary responsibility, primarily to the taxpaying citizens of the Nation, to manage its affairs with the utmost efficiency and economy, and to ferret out waste whenever and wherever possible. It also has a social and ethical responsibility, primarily to its petroleum suppliers, to promote and abide by fair and equitable procurement and business practices, and to ensure that a level playing field is maintained throughout all of its dealings. Finally, it has a business and program responsibility, primarily to its customers and program sponsors, to ensure not only the utmost efficiency and economy, but to also ensure the most effective and predictable program execution possible.

The occurrence of unstable oil market prices, and the current methods of procurement and program management adversely affect each and every one of these mission responsibilities. For example, while contract prices are currently indexed to the market, concerns over DBOF during particularly volatile periods of oil market prices could force DFSC to either:

- return to fixed price contracts and achieve DBOF goals at the expense of placing suppliers at potentially ruinous market price versus contract price risk,
- pass costs along to customers, already strapped by budget cuts and lower operational tempos, in the form of higher standard prices or more frequent and unexpected standard price adjustments,
- or continue to request supplemental appropriations from an already deficit weary Congress that has recently given a "Sense of the Congress" mandate to the Secretary of Defense to reduce operational budgets 25 percent by the year 1998.

Clearly, there is a trade off between all three of these responsibilities. No matter what decision DFSC could possibly make, some stakeholder would be ill served. If DFSC ignores DBOF, it ignores its business/program responsibilities to its program sponsors. If DFSC returns to fixed-price contracts during periods of particularly volatile market conditions, it ignores its social/ethical responsibilities to its suppliers. If DFSC passes avoidable costs along to its customers, it ignores its fiduciary and business/program responsibilities to both the American taxpayer and its customers. Finally, if DFSC continues to request supplemental appropriations from Congress for avoidable costs, it again ignores its fiduciary and business/program responsibilities, but this time to both the American taxpayer and its program sponsors. Using a futures trading strategy may help DFSC avoid having to make one of these difficult trade-off decisions.

An additional mission benefit of futures trading could be experienced during periods of intense mobilization for war, when many procurement procedures are waived due to National necessity. The futures market could be used as an alternate supply mechanism to ensure against supply disruptions or fulfill rapid surge requirements. During periods of critical supply uncertainty, the Government could simply take physical delivery on expiring futures contracts rather than reverse open positions. Instead of closing positions previously established to hedge against price volatility, the Government would let the futures contract run to term and accept delivery of the underlying commodity as a hedge against supply disruption. These commercial grade products could then be further refined or exchanged for military grade fuels if required. (Lee, 1989, p. 29) If cash market contracts are fully hedged in the futures market, this strategy could effectively double the available short run supply of fuel on extremely short notice.

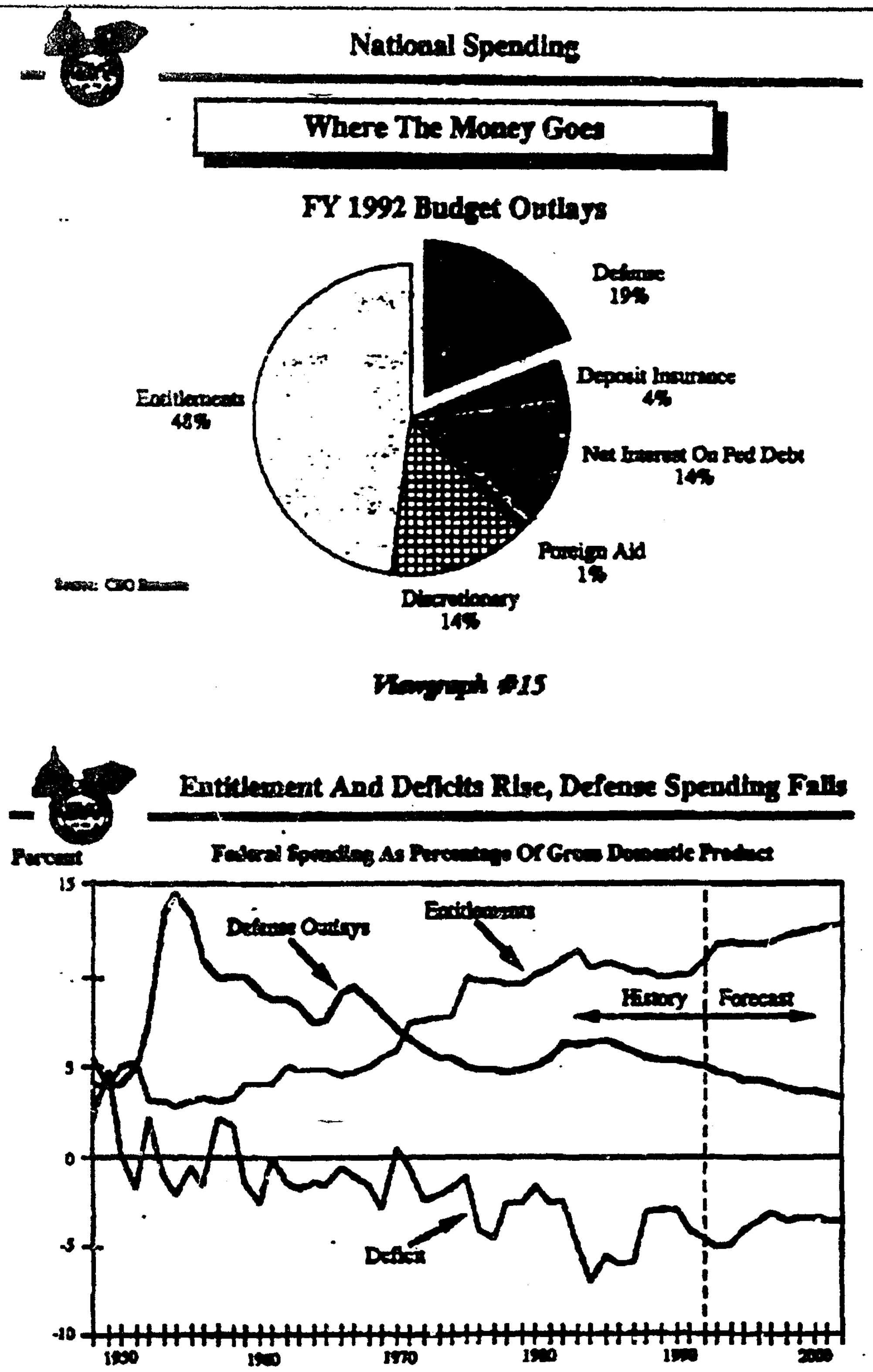
The assessment here is that DFSC has conflicting mission responsibilities which demand tradeoffs. Futures trading may not only reduce tradeoffs, but enhance mission capabilities.

4. External Environment

According to Bryson, an organization must assess the opportunities and threats present in the external environment. These factors can usually be discovered by examining various environmental forces and trends, stakeholder requirements, and situations occurring with potential competitors and collaborators. (Bryson, 1988, pp. 53-54)

Much of DFSC's external environment has already been discussed. Political, economic, and regulatory trends, as well as stakeholder requirements were addressed both in Chapter II and throughout the treatment presented so far in this chapter. However, a few external factors are worthy of note.

As seen in the top section of Figure 29, the two largest portions of the Federal Budget are entitlement programs, like Social Security and Medicare, and the Defense Budget. Entitlement programs remain politically sacrosanct due to the strength and numbers of the politically active aging population. In fact, entitlement funding grows automatically every year unless Congress votes to stop it.



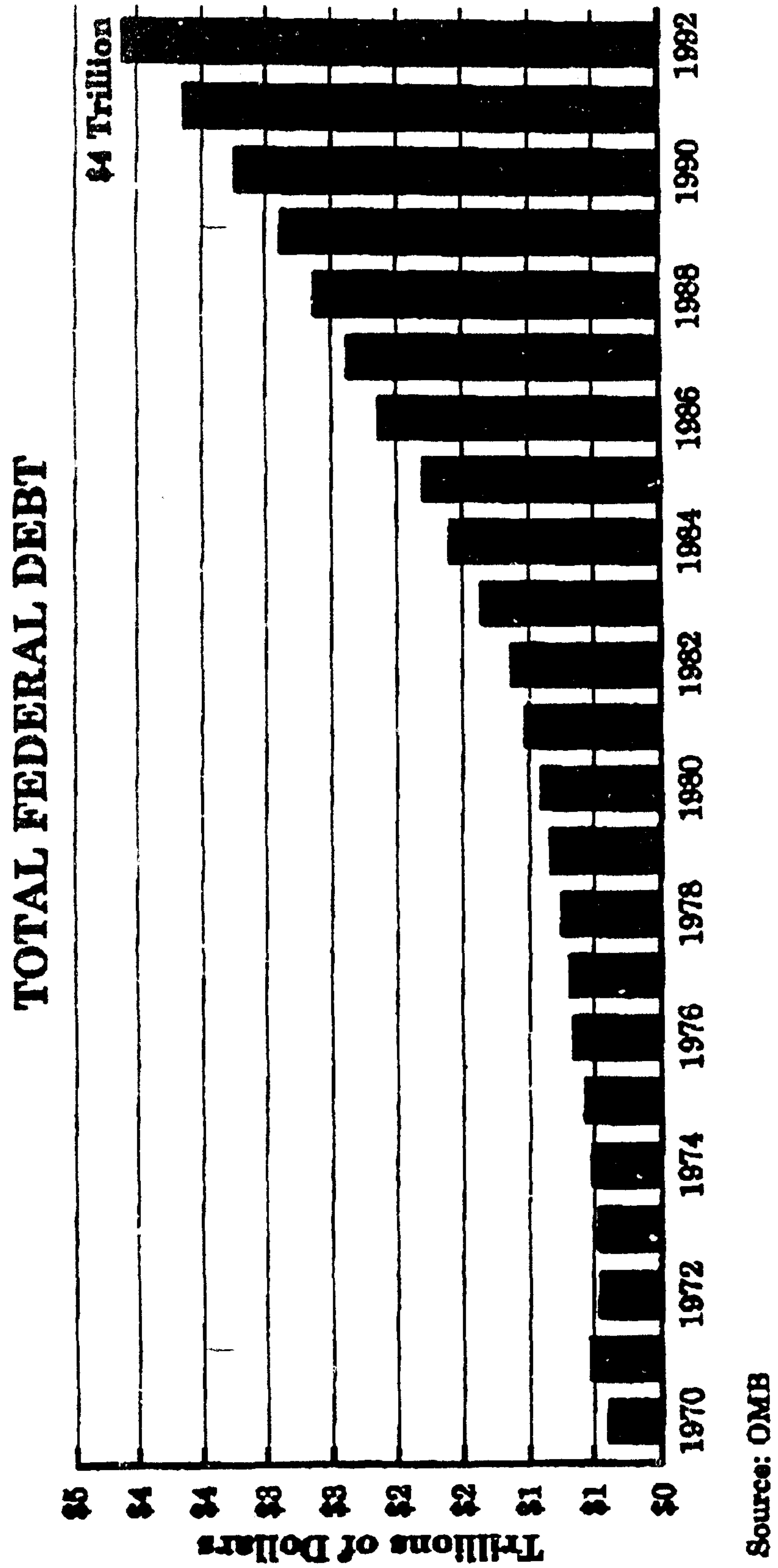
(Couture, 1992, p. 20)

Figure 29 National Spending

Defense funding on the other hand, has become increasingly vulnerable to budget cuts, as can be seen by the trend in the bottom section of Figure 29. This vulnerability is due primarily to the end of the Cold War, the shifting trends in political emphasis toward social reform programs, and the fact that Defense funds are discretionary and must be voted on every year to win approval. (Gansler 1989, p. 79)

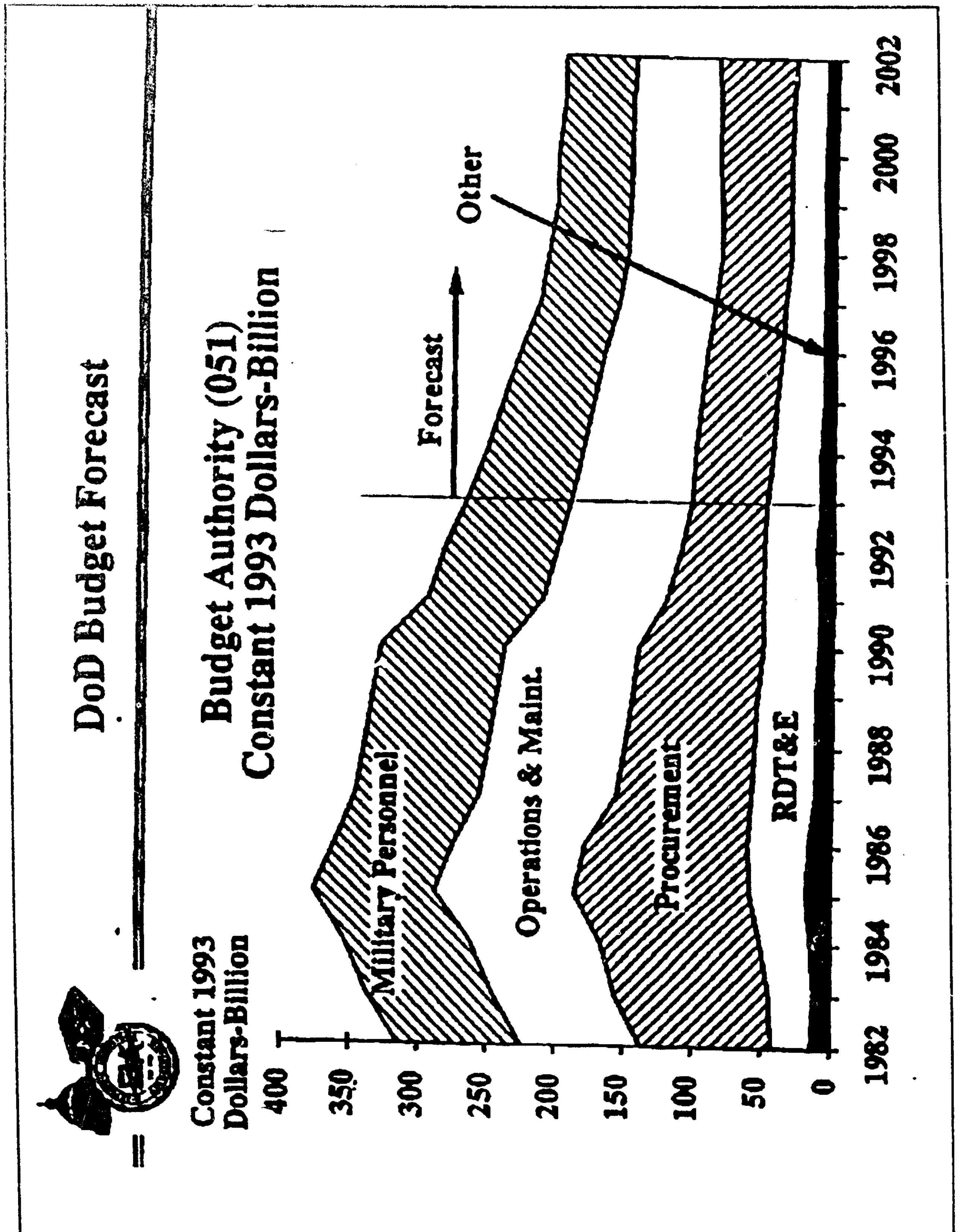
During the 1992 elections, the Federal Deficit and National Debt became major issues as a result of the growing appeal an political presence of billionaire Ross Perot. Perot pointed out that all of the income taxes collected from all of the states west of the Mississippi would be required to pay just the interest on the National Debt. At 14 percent of the annual Federal budget, as seen in the top of Figure 29, the interest on the National Debt is nearly as large as the Defense budget, and is just as large as all other discretionary spending programs put together. As can be seen in Figure 30, the National Debt is now over four trillion dollars and still growing. (Perot, 1992, pp. 6-7)

All of the factors mentioned, have a tremendous impact on the size of the Defense Budget and the composition of its forces. As can be seen in Figures 31 and 32, the trends have been decreasing for some time, with all of the forecasts predicting continued cuts for the foreseeable future. (Couture, 1992, pp. 24-28)



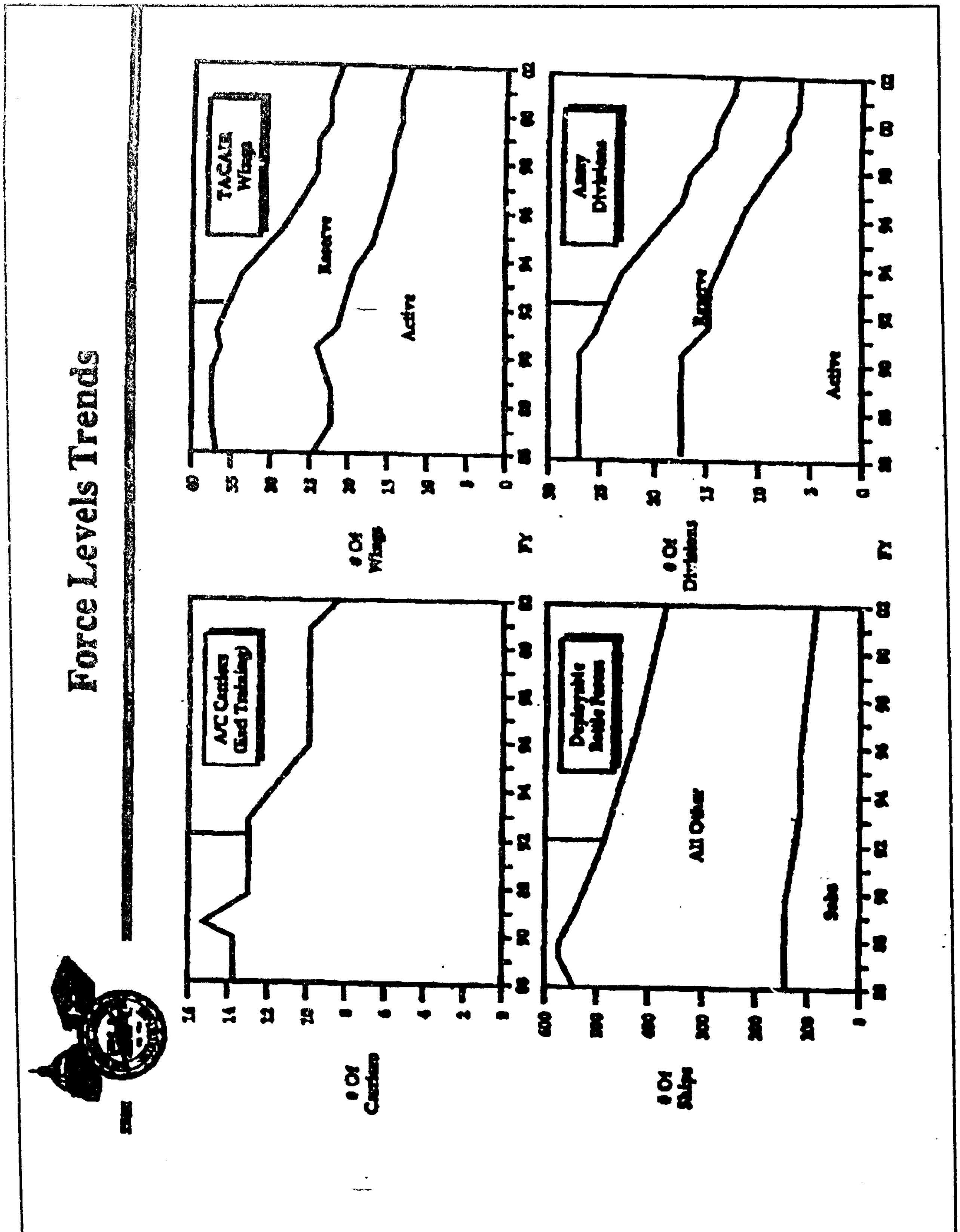
(Perot, 1992, p. 7)

Figure 30 Total Federal Debt



(Couture, 1992, p. 28)

Figure 31 DoD Budget Forecast



(Couture, 1992, p. 24)

Figure 32 Force Level Trends

All of these trends and forecasts spell problems for DFSC, particularly when oil prices are unpredictable. As budgets are squeezed, so is flexibility. While DFSC's ability to rely on traditional procurement practices and reasoning is diminishing, fresh opportunities to look at new approaches like futures trading are becoming more attractive.

In the National Defense Authorization Act of 1994, DFSC was granted authority to sell undesired petroleum products instead of merely trading them, as was previously recommended by the Section 800 Panel. (National Defense Authorization Act, 1993, sec. 826)

Under provisions of the Energy Policy Act of 1992, the Department of Energy (DOE) was directed by the Congress to study the use of futures and options to ascertain whether they could provide cost-effective protection for all Federal Government fuel requirements. Federal financial exposure to oil market volatility was estimated at the time to be between four and six billion dollars per year. (Caruso, 1992)

The Energy Policy Act, which originated in the Senate, was originally targeted for the Department of Health and Human Services to stabilize its severely troubled Low Income Home Energy Assistance Program (LIHEAP). LIHEAP is a winter heating assistance program that distributes $1.35 billion to states, territories, and Indian tribes through block grants. After a steep oil price increase in 1990, Congress had to grant LIHEAP a supplemental appropriation of $50 million. In

1991, $195 million had to be released from a contingency fund to cover LIHEAP price increases related to the Persian Gulf War. The House version of the Bill expanded the program to include a Federal Government-wide approach, and was adopted in the final version. (Caruso, 1992)

Bob Speir, from DOE's Office of Oil and Natural Gas Policy, is conducting the Congressional study for DOE. He plans to complete his work and make his final report to the Congress sometime in 1994. Of particular interest in his study is the research he has done into what the States have done with futures trading strategies. Several states including Texas, New York, Massachusetts and others have already adopted successful futures trading programs. Because many of the lessons learned from the State programs will be incorporated in his report, it promises to be an important body of work worthy of close examination when released.[18]

The assessment here is that external factors provide considerable threat to current business practices, but at the same time make futures trading strategies more attractive. In fact current trends have seen State Governments adopting futures trading practices, trends which could provide valuable guidance for Federal and DoD programs.

[18]Interview between B. Speir, Office of Oil and Natural Gas Policy, Department of Energy, Washington, D.C., and the researcher, 26 August 1993.

5. Internal Environment

According to Bryson, an organization must also assess its own internal strengths and weaknesses. (Bryson, 1988, pp. 54-55) One of the more interesting findings from Bob Speir's study of the States is not that problems in futures trading mechanics are insurmountable, or that the risks prove too great, in fact the opposite is true. The major problem he found, is that in almost all cases, there is a crippling initial internal resistance to the idea of futures trading.[19]

As indicated in Chapter II, DFSC has a highly specialized and professional workforce. This is DFSC's significant strength. There is little doubt that DFSC already has the capability to perform the market analysis required to engage in futures trading. It would of course have to train people to perform the function, and it would also have to develop internal procedures and safeguards. However, in many respects DFSC does not see the need to.

The Defense Fuel Supply Center identified oil market price volatility as being a strategic issue with impact on business operations as early as January of 1992 (Lee, 1992). Under General Bliss, DFSC began to examine procurement practices it felt it could change, which resulted in a number of new strategic ideas as presented in Chapter II (Lee,

---

[19]Interview between B. Speir, Office of Oil and Natural Gas Policy, Department of Energy, Washington, D.C., and the researcher, 26 August 1993.

January 1992). The Defense Fuel Supply Center even went as far as to identify the potential of mission failure as being a possible consequence of not addressing this issue. However the assumption currently being made by DFSC, is that it will always be able to receive supplemental funding. According to Dennis Stanley,

> ...if we have to increase the volume due to war or other unforeseen situation, or pay higher prices due to an oil embargo or shortage, we request supplemental funding from DoD. The DoD in effect does not run out of money to buy fuel because we would risk mission failure. (Stanley, 1993)

However, it was just this same sort of funding practice by the Department of Housing and Human Services, that prompted the Congress to direct the Department of Energy to examine futures trading as a means of price protection in the Energy Policy Act of 1992. (Caruso, 1992)

The final assessment here is that futures trading has as reasonably good strategic fit but that internal resistance may prevent the idea from going any further. An underlying premise of this paper is that in light of all the factors mentioned, DFSC's critical assumption about unlimited supplemental funding should be reassessed. It is one of DFSC's most significant weakness. The simple fact is, if DFSC ignores the problem of price instability, it does risk mission failure. Futures trading is only one of several alternatives worthy of consideration.

D. BARRIERS TO IMPLEMENTATION

Much in line with Bob Speir's research on the problems experienced by the States, DFSC's resistance to futures trading centers around three primary issues, perception, organization, and legislation. There are three primary problems of perception, unfortunately all represent basic misunderstandings of the market that can only be corrected with training and exposure. One pervasive perception is the naive notion that futures trading is gambling (Stanley, 1993). To correct this perception, training would need to point out the clear differences between hedging and speculation as well as the many benefits and problems of each type of trading practice.

An opposite but equally pervasive perception is that hedging operations, because they manage risk, are simply a form of insurance. Since the Government is a self-insurer, hedging operations are unnecessary (Stanley, 1993). Training would need to point out that the primary benefit of futures trading is not insurance, but that it enables managers to make better decisions based upon better information with greater budgetary soundness. As noted in 1968 by Robert S. McNamara, Secretary of Defense under the Kennedy and Johnson Administrations,

> Two points seem to be axiomatic. The first is that the United States is well able to spend whatever it needs to spend on national security. The second point is that this ability does not excuse us from applying strict standards

> of effectiveness and efficiency to the way we spend our Defense dollars. (McNamara, 1968, pp. 88-89)

Another perception is the idea that DFSC's trading would somehow influence or distort the futures market (Stanley, 1993). Although a valid concern, Figure 33 shows that this problem would be extremely unlikely. Even if DFSC were to hedge everything it bought in a year, it would still amount to less than .3 percent of the futures volume and 1.4 percent of the options volume traded on the NYMEX exchange alone. Further, while DFSC's purchases are declining, the futures market is growing. Again, training would have to point out the tremendous size of the futures market and the many trading safeguards in place through both the Commodity Futures Trading Commission and the exchanges themselves, as described in Chapter III.

The Department of Defense has no organizational experience in setting up or running a futures trading program. Justifiably there are many questions surrounding structural issues, controls, and safeguards (Stanley, 1993). However, these types of issues are not particularly unique. Many organizational issues have already been identified and resolved by both industry and Government. The major accounting firm of Coopers and Lybrand has developed a full consulting program devoted to just such issues. Figure 34 diagrams just one example of how an organization can develop and manage a futures trading program. (Coopers and Lybrand)

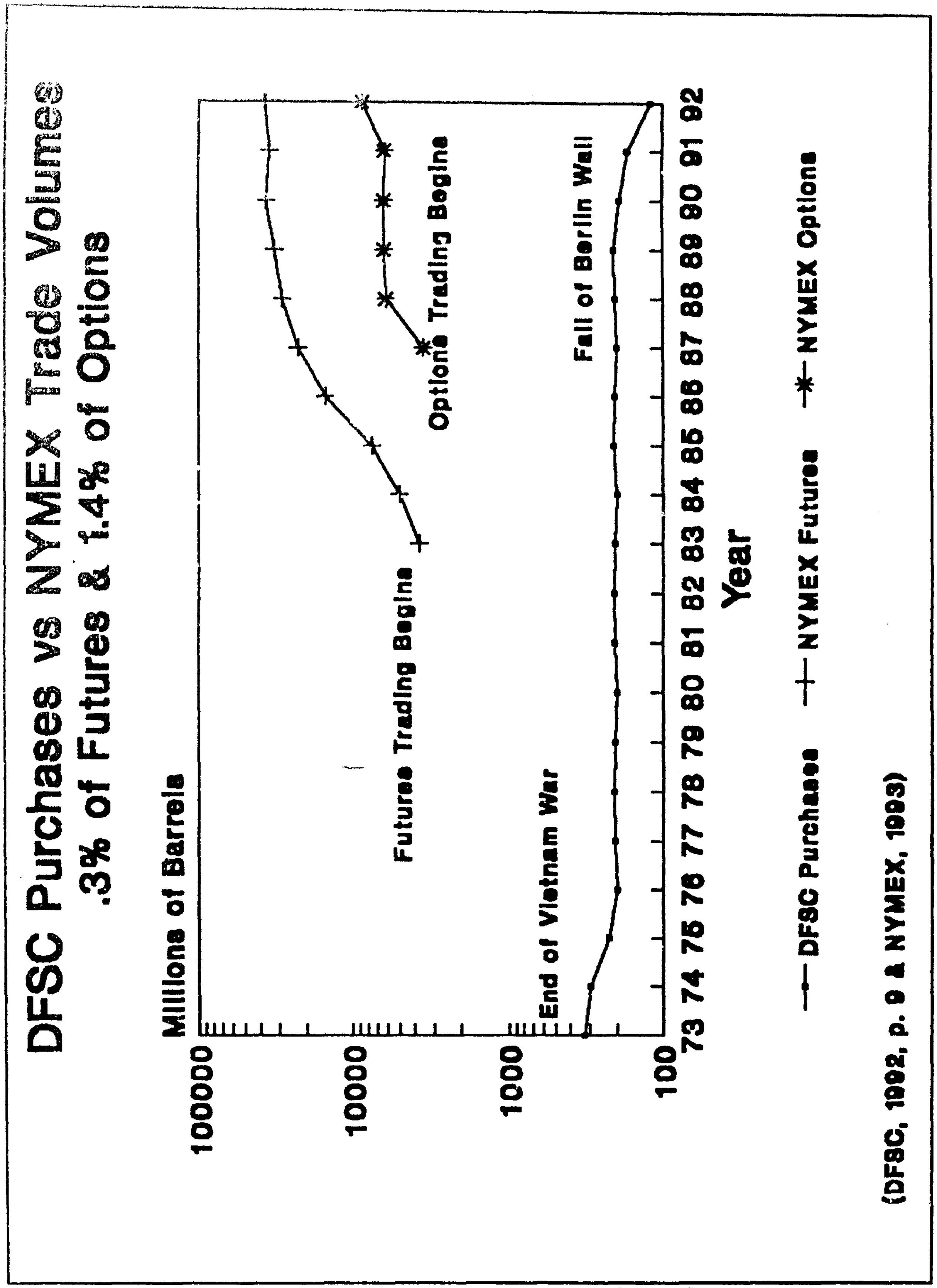
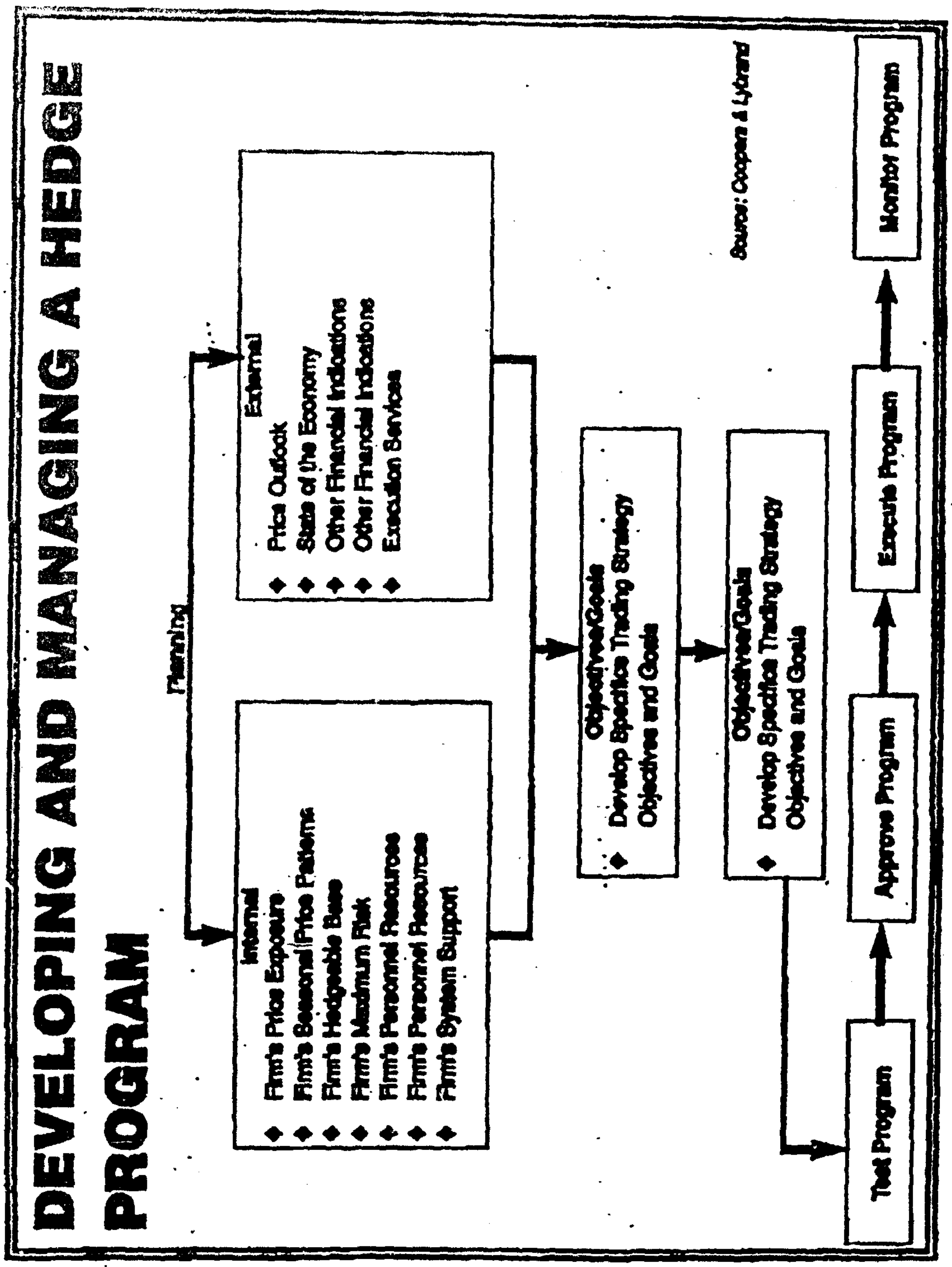


Figure 33 DFSC Purchases vs. NYMEX Trade Volumes



(NYMEX, January 1993)

Figure 34 Hedge Program Development

While some basic reporting procedures would have to be established to keep track of outstanding physical contracts, few if any changes would need to be made to current procurement practices. Futures trading could be a separate financial function totally independent of the physical contracting function. In fact, many State Governments have preferred this approach over integrating futures trading into existing contracting organizations. They have discovered that this functional separation helps to avoid problems with organizational resistance, and generally removes futures trading from the possibility of interpretation under contract law. In other words, many States interpret futures trading as a means of financing, not a means of contracting. This financial interpretation provides invaluable flexibility around statues that tend to slow down the contracting function. However, it generally places futures trading as a State Treasurer or Comptroller responsibility.[20]

For hedging operations to be both nonspeculative and effective, futures contract positions must always mirror real delivery obligations in the physical market. If DFSC were to adopt the comptroller approach taken by many States, it would have to continually coordinate and monitor real time reports of physical contract positions between the comptroller and

---

[20]Interview between B. Speir, Office of Oil and Natural Gas Policy, Department of Energy, Washington, D.C., and the researcher, 26 August 1993.

contracting organizations. The primary purpose for this reporting procedure would be to prevent uncovered speculative futures positions resulting from poor information.

The final apparent barrier to implementation is a lack of specific authorizing legislation. In fact the primary objection to futures trading from DFSC is not so much that it may or may not work, not so much that it may or may not have economic benefit, and not so much that it may or may not have strategic fit, but that it does not have specific authorization (Duval, 1993, pp. 1-10). This single issue appears to be the most onerous because it is the only one which would require some degree of immediate action or sponsorship. Currently there is no sponsorship within DFSC, and as a result there is also no action.

E. LEGISLATIVE PROPOSAL

On December 2, 1993, the graduating Acquisition and Contract Management class at the Naval Postgraduate School, Monterey, CA, held a roundtable discussion on the topic of proposing possible legislative language to authorize futures trading programs within DoD. This discussion was held as part of a capstone policy course examination exercise designed by the researcher. The students and instructor in attendance included representatives from the Navy, Army, Marine Corps, civilian Government Service, and Foreign Military Services, with varying degrees of contracting background and experience. Discussion topics included:

- an overview of DFSC's primary business activity,
- a summary of procurement handicaps and problems,
- a description of futures trading strategies and benefits,
- a discussion of barriers to futures trading and other government entity experiences,
- and a deliberation of issues that would be desirable to include within legislation for authorizing futures trading programs within DoD.[21]

Several ideas were discussed for inclusion in a legislative proposal. As previously noted, there are no clear mandates for or against futures trading. The mandates that are in place are highly subjective and interpretive, but there is a clear DoD policy against speculation. Therefore, clarifying language specifically authorizing futures trading for the explicit purpose of bona fide hedging was considered to be desirable.

Since the concept of futures trading is new and unfamiliar to many people in DoD, some clarifying definitions of key terms would be necessary for program implementation and also desirable in any proposed legislation.

The idea of futures trading has never been tried within the Department of Defense. Hence, there is no experience with managing such a program. The initial program effort should be

---

[21]Round table discussion of graduating Acquisition and Contract Management Students held at the Naval Postgraduate School, Monterey, CA, 2 December 1993.

coordinated, and designed to educate activities on the benefits and potential problems of using futures trading strategies. Time would be required to train contract specialists, market traders, and analysts, and to develop procedures for internal accounting, audit, and control, as well as external reporting. It would be imprudent to initiate into futures trading immediately without spending some time to establish procedures, and it would also make little sense to apply the idea globally without first prototyping it, testing it, and obtaining lessons for latter full scale use.

It might be necessary at first to hire knowledgeable consultants or trade through regulated brokers. Implementing guidance with program limitations and reporting requirements was found to be desirable, but it was felt that the entire idea should be limited in scope to that of a pilot program until unfamiliar issues could be resolved. The group also felt that any legislative language for a pilot program should contain sunset provisions to provide a possible safety valve against unreasonable losses should the futures trading program get out of control.

Trading in a futures market would also require specific funding authorization, and maintenance of margins on account with a regulated exchange or commodity broker. The group felt that any profits gained from trading should be directed back into fuel management programs to help defray fuel procurement costs. Specific language granting appropriation and addressing these issues was considered to be desirable.

Based upon comments made at the Naval Postgraduate School round table discussion, and language found in the state laws of New York, Massachusetts, and Texas, the following language is offered as a guide for use in developing legislative proposals for authorizing futures trading within DoD:[22]

1. Authority to Trade

The Secretary of Defense is authorized to engage in energy futures trading activities for the purpose of establishing or terminating bona fide hedging transactions to increase protection against unanticipated surges in the price of fuel and thereby increase the efficiency of fuel purchases and fuel management programs.

2. Definitions

a. Energy Futures Trading Activities

"Energy futures trading activities" as used in this legislation shall mean the trading, buying, or selling of energy futures contracts for the purpose of establishing or terminating bona fide hedging transactions.

b. Energy Futures Contract

"Energy futures contract" as used in this legislation shall mean an instrument traded, bought, or sold,

[22]State of New York Public Law 9428 and 9431, Commonwealth of Massachusetts H. 4664 through H. 4667, and Texas S.B. 1033.

in a market or exchange regulated by the Commodities Futures Trading Commission, that creates an obligation or an obligation option to make or take delivery of a specific quantity and quality of an energy commodity, to include crude oil, gasoline, heating oil, natural gas, propane, or any other energy product, at a specific location, future date and time.

c. Bona Fide Hedging Transaction

"Bona fide hedging transaction" as used in this legislation shall mean a transaction in a market or exchange regulated by the Commodities Futures Trading Commission, where such transaction or position normally represents a substitute for transactions to be made or positions to be taken at the same or later time in a physical market channel, when such a transaction is economically appropriate to the reduction of risks in the conduct and management of a fuel procurement program.

3. Implementing Guidance and Program Limitations

a. Implementation

The Secretary of Defense shall commence immediately upon the enactment of this legislation to organize the energy purchasing programs of all Defense agencies and authorities to implement such procedures as are necessary or appropriate to educate such entities on the prudent and cost-effective use of energy futures contracts, and to establish internal safeguards and procedures for accounting, audit, control, and reporting.

b. Pilot Program

The Secretary of Defense shall conduct a pilot program of actual futures trading, commencing not later than one year after the enactment of this legislation, or as otherwise directed by the Congress, to ascertain the extent to which the use of energy futures contracts could provide cost-effective protection for Government entities from unanticipated surges in the price of fuel. This pilot program shall expire not more than five years after implementation, or as otherwise directed by the Congress, during which time program progress and lessons learned shall be reported to the Congress not less than annually, or as otherwise determined by the Congress. This pilot program shall terminate in the event and at such a time as determined by Congress, cumulative losses from the net effect of futures trading exceed an acceptable threshold as defined by the Congress. The Comptroller General of the United States shall have oversight authority to ensure compliance with this legislation.

c. Limitations

The scope of this pilot program shall limit the Secretary of Defense to not exceed a total of ten percent open hedged positions in the futures market as compared to the value of comparable agency contracts established in a physical market channel for actual delivery of similar energy products, or limits as otherwise defined by Congress.

4. Funding Authorization and Maintenance of Margins

The Secretary of Defense shall be authorized through appropriations, or as otherwise determined by the Congress, such sums as may be necessary to carry out the requirements of preparation and implementation of the five year pilot program, and to maintain as necessary adequate trading margins on account with an exchange or market intermediary dually regulated by the Commodities Futures Trading Commission. Any net profits realized from energy futures trading shall be retained in the same appropriation account for continued use in a fuel cost management program.

F. SUMMARY

While futures trading has a reasonably good strategic fit, DFSC's organizational resistance may keep the idea from proceeding any further. The barriers to implementation center on three primary issues, perception, organization, and legislation. Of these, legislative authorization appears to be of primary importance. Because of this barrier, a proposal for legislative language is offered as a guide.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CHAPTER OVERVIEW

This chapter briefly summarizes the intent and general focus of the various topics discussed throughout this thesis. This chapter also offers specific conclusions and recommendations based upon an interpretive assessment of the research completed. Finally, this chapter addresses and answers each of the research questions posed in Chapter I.

B. THESIS REVIEW

This thesis has present a logical and objective assessment about issues surrounding the primary research question of whether DFSC should trade in the futures market. In discussing these difficult and often complex issues, many of which are both economic and political, particular attention was paid in trying to determine the viability and wisdom of futures trading for DFSC, considering DoD's current environment.

In working toward these goals, this research paper examined many of the potential benefits and problems associated with futures trading. It also described the context of DFSC's organization and the relevant public sector environment. It identified problems in current contracting practices and described what would be required to implement futures trading.

This thesis also explained futures trading mechanisms and markets. It examined the various markets and factors affecting the prices of futures contracts. It explained the connection between prices in the futures market and the spot prices of the underlying oil commodities they represent.

This thesis also provided ways of assessing and measuring futures performance. It explained basic strategy design, and illustrated a workable strategy that could be used develop more sophisticated strategies.

Finally, this thesis examined futures trading in terms of its strategic fit. Based upon a roundtable review of the laws enacted in several States experienced with futures trading programs, it offered legislative language that could be used as a guide for developing proposals to authorize futures trading within DoD.

C. CONCLUSIONS

Based upon the data and discussion presented throughout this thesis, futures trading appears to be both a viable and wise strategy for DFSC. It could reduce DFSC's exposure to unpredictable oil market prices, and is clearly in line with the recent thrust of Government recommendations and mandates to move towards adopting innovative commercial practices. Futures trading would provide DoD with the flexibility needed to adapt its petroleum purchase and management programs to actual market conditions.

Because futures trading would improve market flexibility, it would also improve DFSC's ability to effectively and efficiently carry out its mission. This feature is particularly important because of the critical role that oil, and hence DFSC, plays in military readiness. Futures trading would provide greater budgetary certainty during unstable market conditions. As a result, it would better serve the needs of all of DFSC's stakeholders by reducing the tradeoffs required to meet DFSC's various responsibilities.

Implementing futures trading would require minimal changes to existing contracting practices. In fact, current contracting practices would continue unimpeded by a futures trading program. Thus, not only could implementation proceed with few disruptions to DFSC's basic mission, but it would actually improve mission capability during times of pre-war surge because futures trading also offers an alternate supply channel.

Finally, because futures trading has never been tried within DoD, if implemented it should be done with prudent care. Implementation would require adequate preparation and training, appropriate safeguards and reporting procedures, and careful attention to lessons that could be learned both before and during the process. Implementation should be limited to that of a pilot project and refined over several years before expanding to full scale use.

D. RECOMMENDATIONS

After General Bliss departed DFSC in July of 1993, all of the momentum towards exploring alternative procurement strategies was lost. Due to the environmental, economic, and political factors and trends mentioned extensively throughout this thesis, and the many disadvantages of current procurement practices, DFSC should continue to explore alternative ideas. Because the time for new ideas is ripe, these ideas should not be limited to futures trading, traditional approaches, or the ideas presented in Chapter II, but should include a quest for ideas not yet discovered.

In particular, DFSC should seize the opportunity to reexamine the idea of futures trading in terms of DFSC's strategic environment, as was done in Chapter VI. DFSC should reassess its mission objectives in terms of its responsibilities to its various stakeholders. As a goal, DFSC should strive to achieve budget stability and program predictability during periods of oil price volatility. Given the constant uncertainty of the environment, this long-term goal appears to be the one that would best serve all of DFSC's various stakeholders.

E. RESEARCH QUESTIONS

The research questions posed in Chapter I are addressed as follows:

1. Primary Research Question

- **Should the Defense Fuel Supply Center trade in the futures market?** - Based upon the data and discussion presented throughout this thesis, futures trading is both a viable and wise strategy for DFSC, but it should also be compared with other innovative strategies, such as those presented in Chapter II, before implementation.

2. Subsidiary Research Questions

- **What are the potential benefits of the Defense Fuel Supply Center trading in the futures market?** - Futures trading would reduce DFSC's exposure to unpredictable oil prices. It improves flexibility to adapt to actual market conditions and thereby improves DFSC's ability to carry out its mission. Futures trading would provide greater budgetary certainty during unstable market conditions and as a result would better serve the needs of DFSC's stakeholders. It also offers an alternate supply channel feature, that would actually improve mission capability during times of pre-war surge.

- **What are the potential problems of the Defense Fuel Supply Center trading in the futures market?** - Although a common commercial practice, futures trading has never been tried within DoD. There are perception and organizational problems, and legal hurdles to overcome. There are also risks that improper speculation activities could lead to losses if not properly prevented and managed. If implemented, it should be carefully planned and tried on a small scale. Time should be allowed for adequate preparation and training, as well as to develop appropriate safeguards and reporting procedures. Time should also be allocated to adequately test the program. Prudent attention should be paid to lessons that could be learned both before and during the process. Authorizing legislation should contain sunset provisions to stop and reevaluate the program should it exceeds loss limits.

- **What contracting practices or changes would be required to implement a futures trading strategy?** - Implementation of futures trading would require minimal changes to existing contracting practices. While current contracting practices could continue unimpeded, an accurate and real time method of reporting or establishing the hedge base would be critical if physical contracts are to be fully hedged. This real time reporting would be required to prevent speculative futures positions. Futures trading is a highly specialized activity that would require extensive training. Many successful State programs have made futures trading a comptroller function as opposed to a contracting function.

- **What are the price drivers in futures contracts and how do they compare with the underlying commodity spot market?** - There are numerous factors that drive oil prices in the commodities spot markets, as explained in Chapter IV. The two most common approaches for determining these factors are fundamental and technical market analysis. Generally, futures contract prices reflect the market consensus of commodity price expectations in the future. Four different theories describe the actual relationship of the futures market to the spot market. However, all four theories agree that as a futures contract gets closer to expiration, the futures price gets closer to the spot price.

- **What are potential ways of measuring futures trading performance?** - One way of looking at futures performance is to consider the value it gives to someone by providing a payoff or cost that is certain as opposed to a payoff or cost that is uncertain. This value can be approximated using the concept of utility. Because of their fixed-price effect, futures contracts provide a higher utility for normally risk adverse individuals than exposure to market price volatility. Another way of looking at futures performance is to see if it meets some price protection and participation objective. Futures trading strategies can be developed that would protect against market price increases but also allow participation during market price decreases. These strategies could result in substantial savings.

- **Does futures trading have a strategic fit within the Defense Fuel Supply Center?** - According to Bryson's eight step model, futures trading would be considered a very attractive alternative for resolving the strategic issues and problems created by unpredictable oil market prices. The strategy fits nicely within DFSC's mandates, mission, external and internal environment, and is also in keeping with the current timing opportunity and public sector agreement over the need for fundamental change within Government systems and processes.

F. AREAS FOR FURTHER RESEARCH

Areas for further research were described at the end of Chapter II. These alternative strategies include:

- Seasonal Stock Building and Drawdown,
- Timing of Procurements,
- Term/Spot Procurement Mix,
- Lift Scheduling,
- and Posts, Camps, and Stations Deliveries.

G. SUMMARY

This thesis concluded that futures trading is both a viable and wise strategy for DFSC. Because the timing is ripe, DFSC should reevaluate its strategies and mission objectives and continue to explore alternative ideas to traditional procurement approaches. These ideas should not be limited, but should fit the circumstances of the current environment. While futures trading is recommended, each of the research questions posed should be carefully evaluated to fully understand what is involved. If DFSC decides to implement a futures trading strategy, it should do so cautiously, and on a small scale. Futures trading requires sufficient preparation and planning. Adequate procedures and safeguards should be established prior to any actual trading.

LIST OF REFERENCES

Acquisition Law Advisory Panel, *Streamlining Defense Acquisition Laws, Report of the Acquisition Law Advisory Panel to the United States Congress*, Government Printing Office, Washington, D.C., January 1993.

Adelman, M. A., *The World Petroleum Market*, The Johns Hopkins University Press, Baltimore, MD, 1972.

Brigham, E. F., *Fundamentals of Financial Management*, 6th ed., Dryden Press, New York, NY, 1992.

British Petroleum Company, *BP Statistical Review of World Energy*, Leycol Printers Ltd., London, England, June 1993.

Bryson, J. M., *Strategic Planning for Public and Nonprofit Organizations, A Guide to Strengthening and Sustaining Organizational Achievement*, Jossey-Bass Publishers, San Francisco, CA, 1988.

Caruso, G., Department of Energy Memorandum, Subject: *Energy Policy Act Futures and Options Study*, 23 October 1992.

Cassady, R. Jr., *Price Making and Price Behavior in the Petroleum Industry*, Kennikat Press, Port Washington, NY, 1954.

Chapin, D. H., *Opportunities to Strengthen Management of the Defense Business Operations Fund*, Testimony before the Subcommittee on Readiness Committee on Armed Services House of Representatives, General Accounting Office, Washington, D.C., 13 May 1993.

Coopers and Lybrand, *Hedging with NYMEX Energy Futures: Operational and Accounting Controls, Financial Reporting and Federal Income Taxes - A Practical Guide*, Coopers and Lybrand, New York, NY.

Couture, L., *Defense Electronics Market Ten-Year Forecast, U.S. Department of Defense and National Aeronautics and Space Administration Budgets, FY 1993 to FY 2002*, Electronic Industries Association, 20 October, 1992.

Customer Assistance Handbood, 10th ed., NAVSUP Publication 585, 1991.

Defense Fuel Supply Center, *Contract Solicitation DLA600-93-R-0061*, Alexandria, VA, 1993.

Defense Fuel Supply Center, *Directorate of Contracting and Production, Fiscal Year 1991, Blue Plate Special*, Alexandria, VA, 1991.

Defense Fuel Supply Center, *Directorate of Contracting and Production, Fiscal Year 1992, Blue Plate Special*, Alexandria, VA, 1992.

Defense Fuel Supply Center, *We Fuel the Forces*, business proposal presented to VADM E. Straw, Executive Director, Defense Logistics Agency, Alexandria, VA, April 1993.

Defense Logistics Agency Command Support Office, *Defense Logistics Agency, Defense Fuel Supply Center*, Organization Chart, DASC-WP Publications Distribution, Alexandria, VA, July 1993.

Defense Logistics Agency Command Support Office, *Defense Logistics Agency*, 1st ed., Organization Chart, DASC-WP Publications Distribution, Alexandria, VA, July 1993.

Defense Science Board, *Report of the Defense Science Board Task Force on Defense Acquisition Reform*, Office of the Under Secretary of Defense for Acquisition, Washington, D.C., July 1993.

Department of Defense Advisory Panel, *Section 800 Report Summary, DoD Advisory Panel on Streamlining and Codifying Acquisition Laws*, National Contract Management Association, Vienna, VA, 1993.

Department of Defense FAR Supplement as of June 1, 1989, Commerce Clearing House, Inc., Chicago, IL, 1989.

Department of Defense, *Selling to the Military*, U.S. Government Printing Office, Washington, DC.

Duval, B. A., Memorandum of Law, DFSC-G, Subject: *Legality of DFSC's Use of Commodity Futures and Options Contracts in Connection with its Petroleum and Natural Gas Purchases*, 11 June 1993.

Eckbo, P. L., *The Future of World Oil*, Ballinger Publishing Company, Cambridge, MA, 1976.

Energy in the News, 10th Year Anniversary Insert, Spring 1993.

Ervin, L. C., *Tactical Buying Decisions for Strategic Petroleum Reserve Spot Procurements: The Tunnel Theory*, Defense Fuel Supply Center, Alexandria, VA, 1984.

Federal Acquisition Regulation as of May 1, 1989, Commerce Clearing House, Inc., Chicago, IL, 1989.

Francis, J. C., *Investments, Analysis and Management*, 3rd ed., McGraw-Hill Book Company, New York, NY, 1980.

Freeman, C., and Gandy, M., *Defense Logistics Agency*, Command Brief, Defense Logistics Agency Weapon Systems Support Office, Mechanicsburg, PA, 1989.

Gansler, J. S., *Affording Defense*, MIT Press, Cambridge, MA, 1989.

Gates, W., *Gambling and Life Insurance*, lecture notes presented at the Naval Postgraduate School, Monterey, CA, 10 April, 1992.

Gore, A., *From Red Tape to Results, Creating a Government that Works Better and Costs Less, Report of the National Performance Review*, Superintendent of Documents, Pittsburgh, PA, 7 September 1993.

Gotthelf, P., "Technical Analysis Offers Another Way of Looking at the Market", *Energy in the News*, pp. 12-15, Spring 1993.

Hart, J., "Buying Fuel for Defense," *Army Logistician*, pp. 33-36, May-June 1990.

Hart, J., "The Oil Market and the US Defense Budget," *Air Force Journal of Logistics*, pp. 8-11, Summer 1989.

Herman, R. J., Memorandum to the Chairman, Defense Science Board, Subject: *Report of the Defense Science Board (DSB) Task Force on Defense Acquisition Reform*, 30 June 1993.

Hochheiser, R. M., *How to Work for a Jerk, Your Success is the Best Revenge*, Vintage Books, New York, NY, 1987.

Horwich, G. and Weimer, D. L., *Oil Price Shocks, Market Response, and Contingency Planning*, American Enterprise Institute for Public Policy Research, Washington, D.C., 1984.

Houthakker, H. S., *The World Price of Oil - A Medium-Term Analysis*, American Enterprise Institute for Public Policy Research, Washington, D.C., 13 October 1976.

Lee, C., "Adversarial Nature of Government Contracting," *Program Manager*, pp. 29-33, March-April 1990.

Lee, C., "Contracting for Military Fuels: An Analysis of Peacetime Supply Disruptions", *Air Force Journal of Logistics*, pp. 25-40, Fall 1989.

Lee, C., "Government Contracting: A Game-Theoretic Analysis," *Public Contract Law Journal*, v. 19, pp. 382-392, Winter 1990.

Lee, C., Memorandum to DFSC-D/DD, Subject: *Trip Report - 4 June Trip to Metallgesellschaft (MG) Offices in Forest Hills, Maryland*, 1992.

Lee, C., Memorandum to the Commander of DFSC, Subject: *Consideration of Market Price Fluctuations in the Procurement of DFSC Product*, 23 January 1992.

MacAvoy, P. W., *Crude Oil Prices as Determined by OPEC and Market Fundamentals*, Ballinger Publishing Company, Cambridge, MA, 1982.

McCormack, M. H., *What They Don't Teach You at Havard Business School, Notes from a Street-Smart Executive*, Bantam Books, New York, NY, September 1984.

McNamara, R. S., *Essence of Security*, Harper and Row Publishers, Inc., New York, NY, 1968.

Moran, T. H., *Oil Prices and the Future of OPEC*, Resources for the Future, Inc., Washington, D.C., 1978.

National Defense Authorization Act of 1994, 1993.

Navy Energy and Natural Resources Research and Development Office, Report TT-A-6054-79-403, *Department of the Navy Energy Fact Book*, by Tetra Tech, Inc., May 1979.

New York Mercantile Exchange, *New York Mercantile Exchange Glossary*, NYMEX, New York, NY, December 1992.

New York Mercantile Exchange, *Managing Energy Price Risk: A Seminar for Government Officials, Regulators, and Utility Executives*, NYMEX, New York, NY, 19-20 April 1993.

New York Mercantile Exchange, *NYMEX*, NYMEX Visitor Presentation, New York, NY, 13 January 1993.

New York Mercantile Exchange, *NYMEX Energy Complex*, NYMEX, New York, NY, November 1992.

New York Mercantile Exchange, *NYMEX Energy Options, Strategies at a Glance*, NYMEX, New York, NY, September 1992.

New York Mercantile Exchange, *Petroleum Marketers Handbook*, NYMEX, New York, NY.

New York Mercantile Exchange, *Risk Management - Is it Risky?*, NYMEX, Washington, D.C.

New York Mercantile Exchange, *Safeguards and Standards*, NYMEX, New York, NY, 22 March 1993.

Osborne, D. and Gaebler, T., *Reinventing Government, How the Entrepreneurial Spirit is Transforming the Public Sector*, Plume, New York, NY, 1992.

Perot, R., *United We Stand, How We Can Take Back Our Country, A Plan for the 21st Century*, Hyperion, New York, NY, 1992.

Peters, T. J., and Waterman, R. H. Jr., *In Search of Excellence, Lessons from America's Best-Run Companies*, Warner Books, New York, NY, 1982.

Quick, W. H., "In Pursuit of Profits in the Oil Trading Markets," *Oil and Gas Journal*, pp. 44-48, 9 November 1992.

Ridgeway, J., *Who Owns the Earth*, Collier Books, New York, NY, 1980.

Rifai, T., *The Pricing of Crude Oil - Economic and Strategic Guidelines for an International Energy Policy*, Praeger Publishers, New York, NY, 1975.

Robinson, J., Mills, G., and Bower, J. L., *TFX: The Commonality Decision*, Case Study, Kennedy School of Government, Harvard University, 1974.

Sharpe, W. F., *Investments*, 2nd ed., Prentice-Hall, Inc., Englewood Cliffs, NJ, 1981.

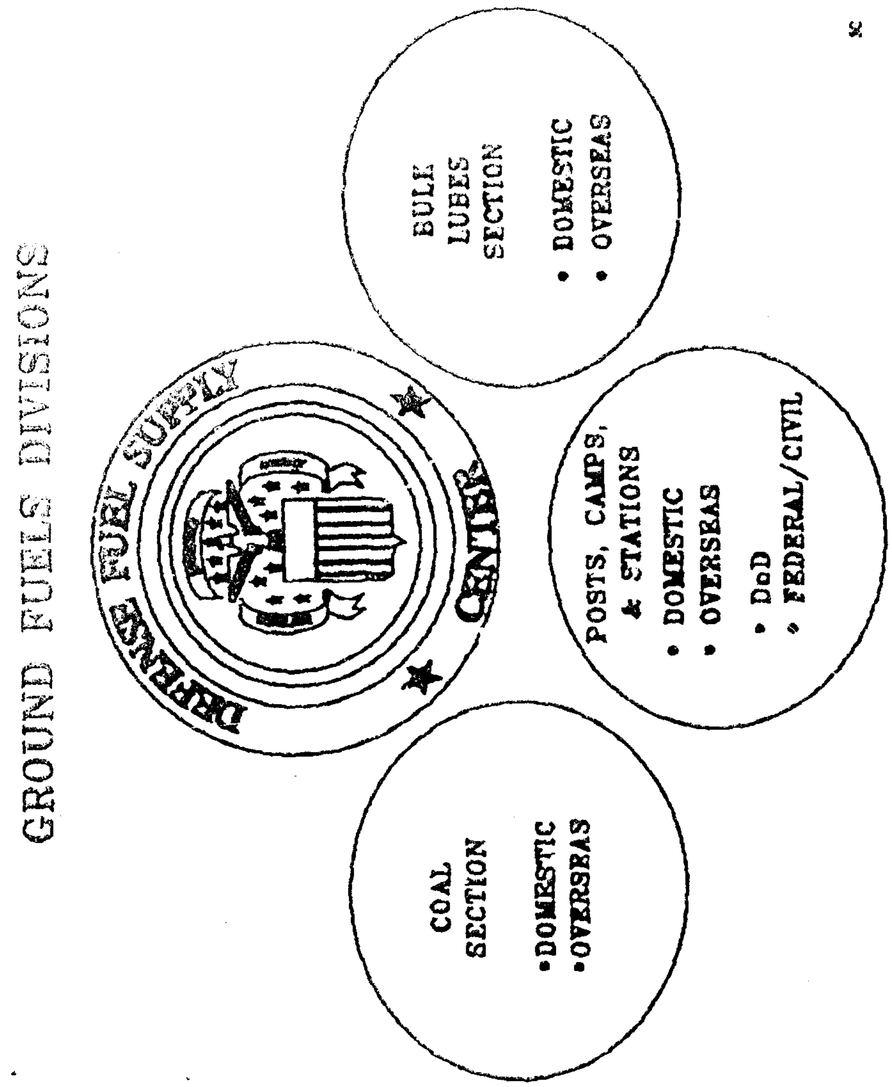
Stanley, D., Memorandum for the Record, DFSC-PPR, Subject: *Procurement Comments Regarding Hedging*, 24 August 1993.

Verleger, P. K. Jr., *Oil Markets in Turmoil - An Economic Analysis*, Ballinger Publishing Company, Cambridge, MA, 1982.

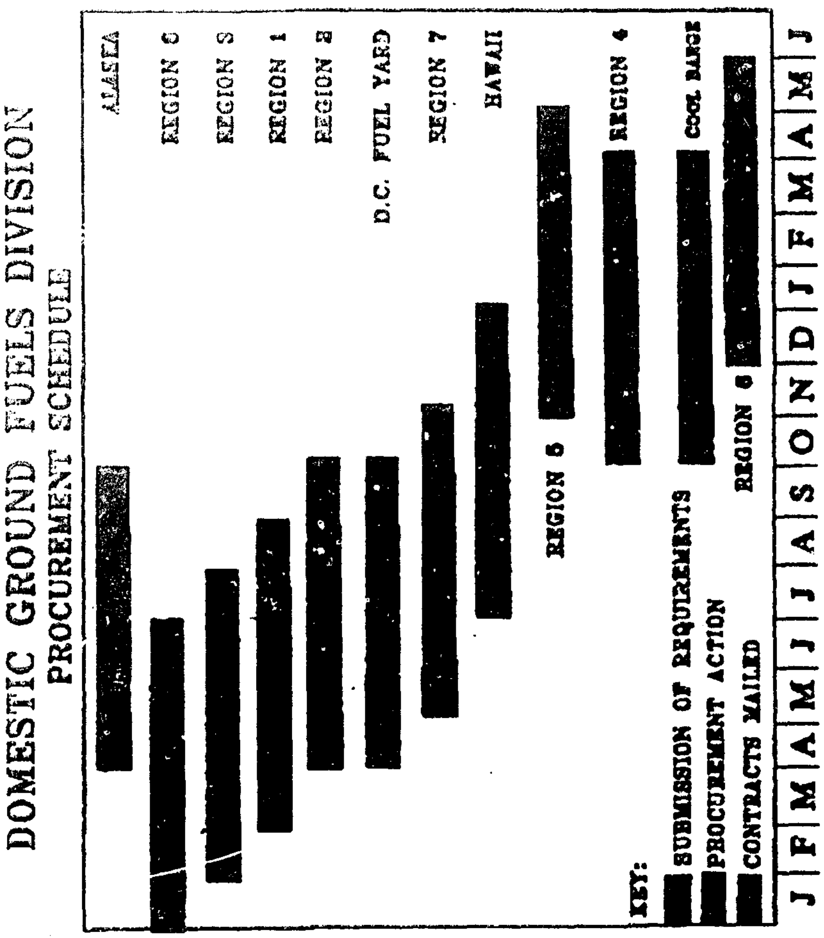
Wald, M. L., "Why Some Oil Prices Rise While Others Rise Faster," *The New York Times*, p. E-7, 4 November 1990.

Yergin, D., *The Prize - The Epic Quest for Oil, Money, and Power*, Simon and Schuster, New York, NY, 1992.

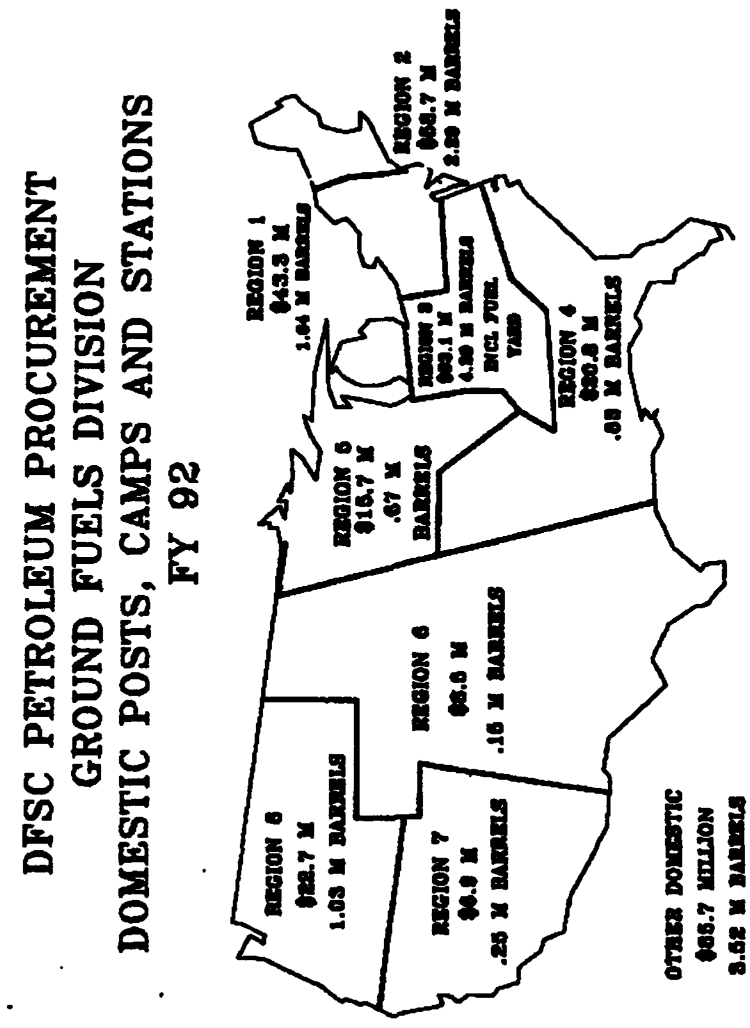
APPENDIX A - GROUND FUELS DIVISIONS



(DFSC, 1992, p. 30)



(DFSC, 1992, p. 31)



(DFSC, 1992, p. 32)

GROUND FUELS DIVISIONS
FY 92
DOMESTIC POSTS, CAMPS, AND STATIONS

	NUMBER OF LINE ITEMS	NUMBER OF ACTIVITIES	QUANTITY (MILLION BARRELS)
DoD	3,293	1,700	12.58
NON-DoD	2,882	1,650	4.55
TOTAL	6,175	3,350	17.13

NON-DoD ACTIVITIES

POSTAL SERVICE

VETERANS ADMINISTRATION

GEN. SVCS. ADMIN.

NASA

DEPARTMENTS OF --

AGRICULTURE

COMMERCE

ENERGY

INTERIOR

JUSTICE

TRANSPORTATION

33

(DFSC, 1992, p. 33)

DOMESTIC POSTS, CAMPS, AND STATIONS
FY 92

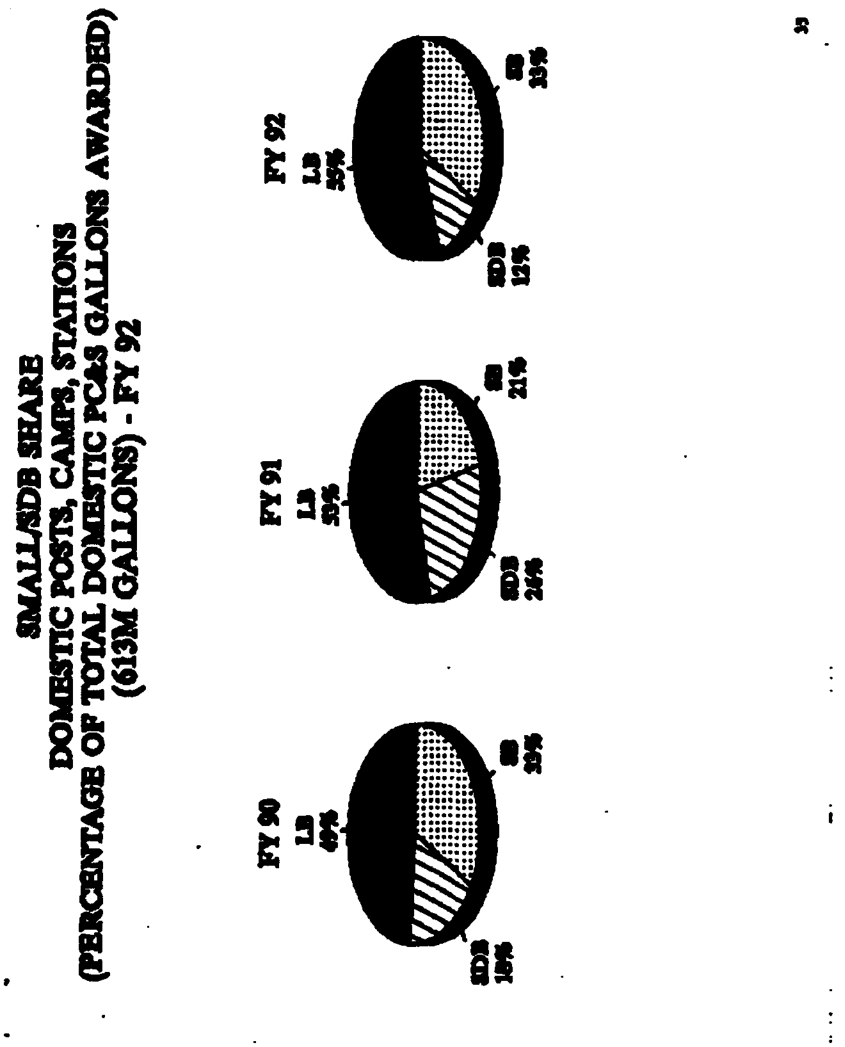
REGION	GALLONS (MILLIONS)	AWARD ACTIONS**	SMALL BUSINESS AWARD ACTIONS**	SDB AWARD ACTIONS**
1	69.2	91	66	3
2	96.2	105	87	9
3	18.1	258	176	42
4	34.7	89	75	18
5	28.2	145	112	3
6	2.4	134	127	20
7	10.6	98	85	18
8	43.3	103	100	7
OTHER DOMESTIC	148.0	65	33	13
TOTALS	450.7	1,086*	861	123

* INCLUDING EMERGENCY PURCHASES

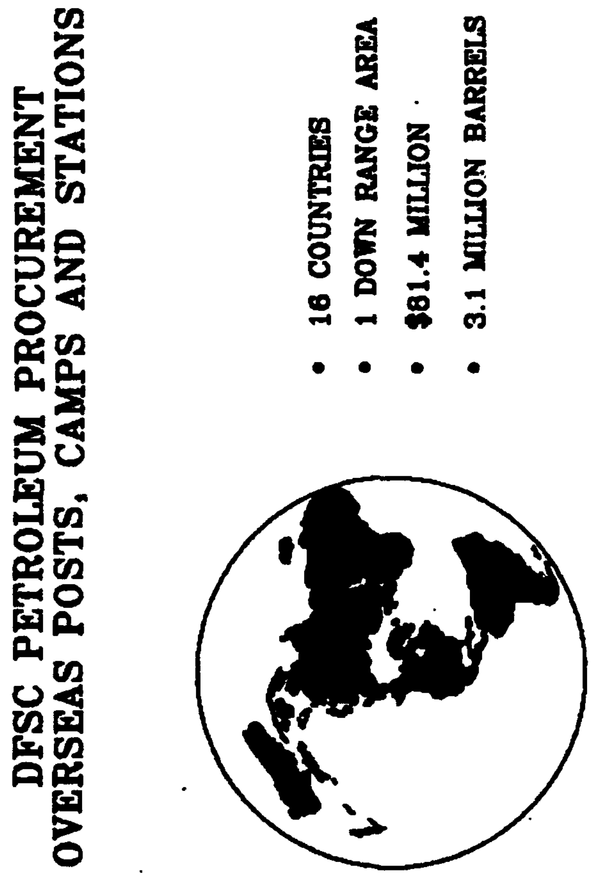
** INCLUDES ALL CONTRACTS AND MODIFICATIONS THERETO

34

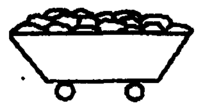
(DFSC, 1992, p. 34)



(DFSC, 1992, p. 35)



(DFSC, 1892, p. 36)



POSTS, CAMPS, AND STATIONS COAL PROGRAM FY 92

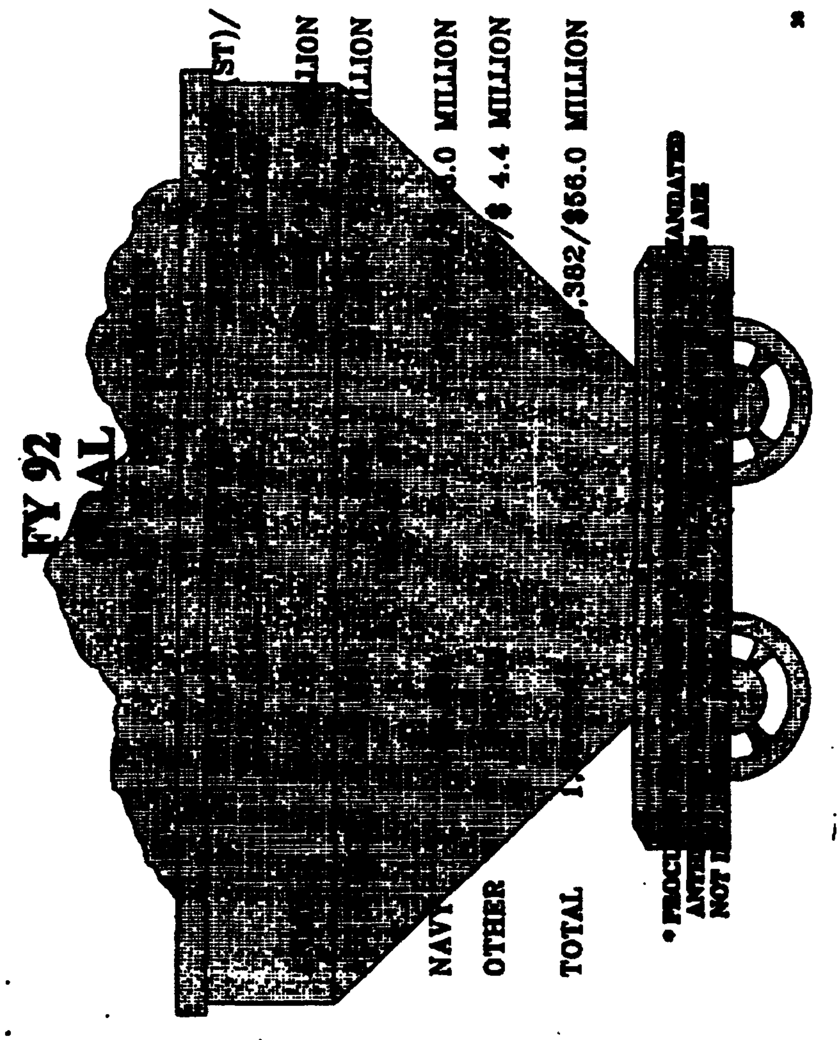
- DOMESTIC
  - CUSTOMER — 96% MILITARY AND 4% FEDERAL ACTIVITIES
  - REQUIREMENTS — 1.3 MILLION SHORT TONS PER YEAR (OVER 900 MILLION SHORT TONS TOTAL DOMESTIC PRODUCTION)
- OVERSEAS
  - CUSTOMER — U.S. FORCES IN GERMANY
100% AIR FORCE
  - REQUIREMENTS — 23,000 METRIC TONS ANTHRACITE (NUT SIZE)

TOTAL: 1.3 MILLION TONS

$66 MILLION

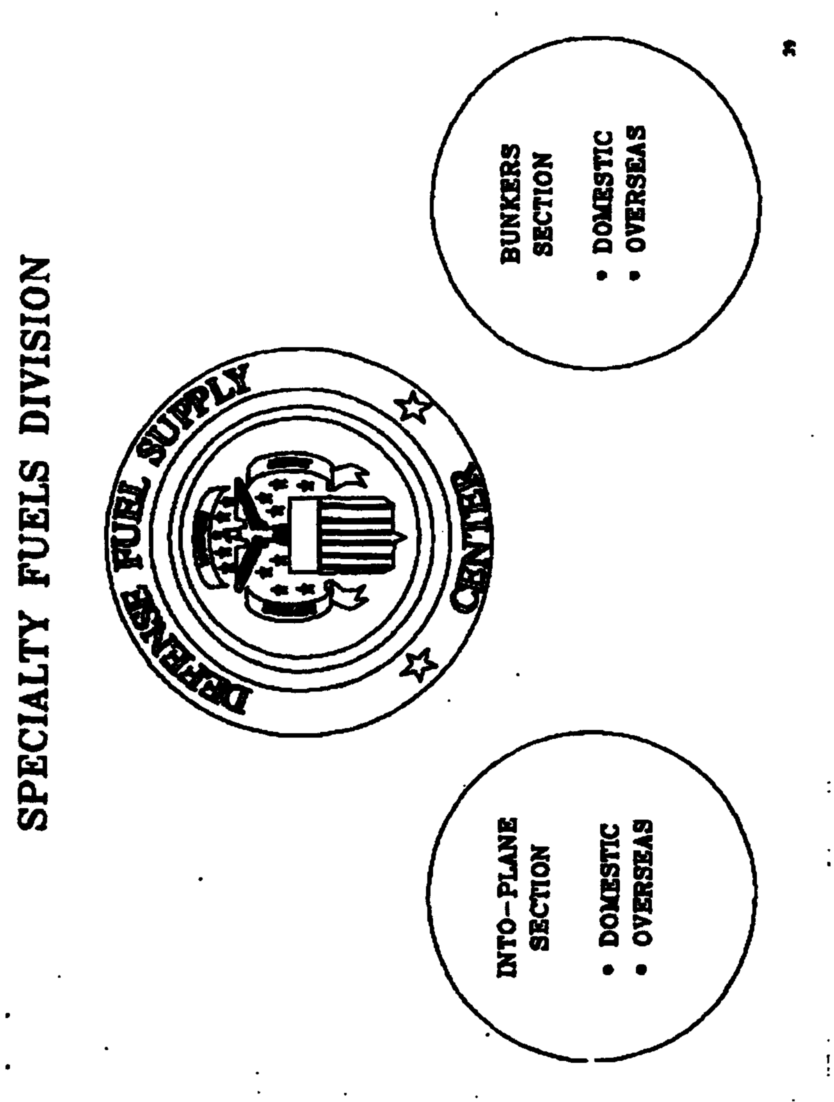
37

(DFSC, 1992, p. 37)

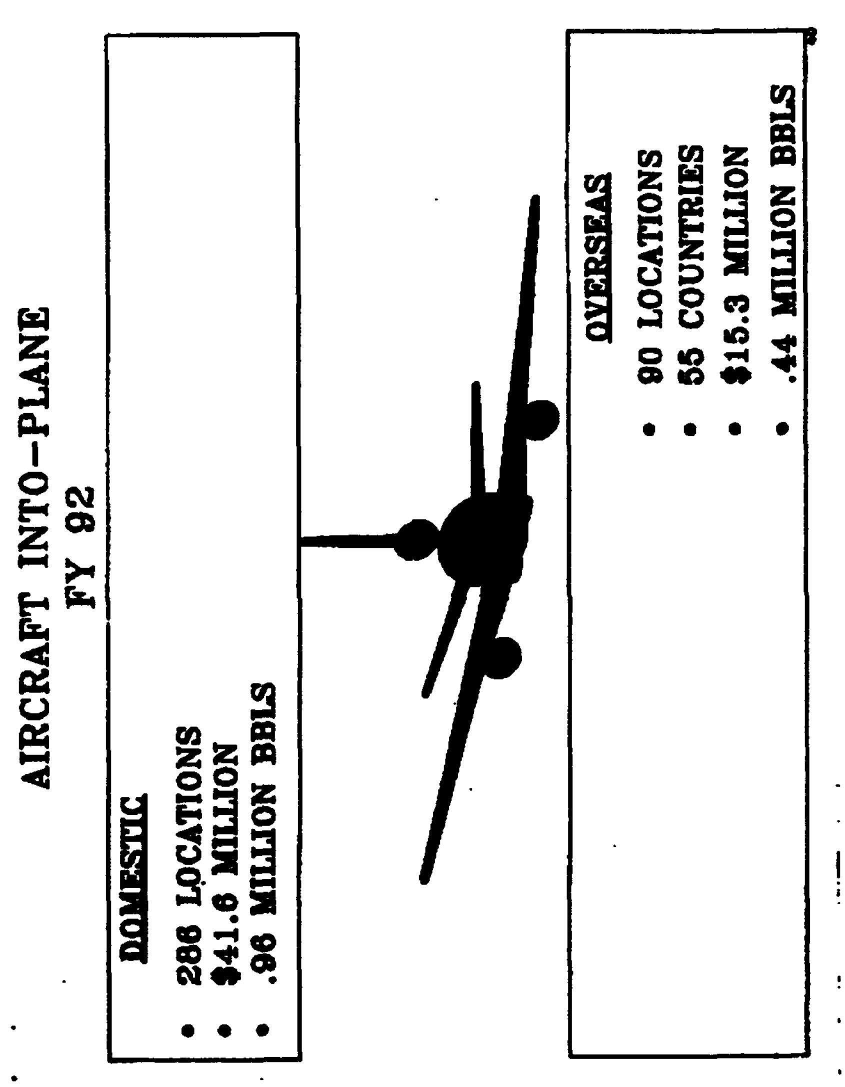


(DFSC, 1992, p. 38)

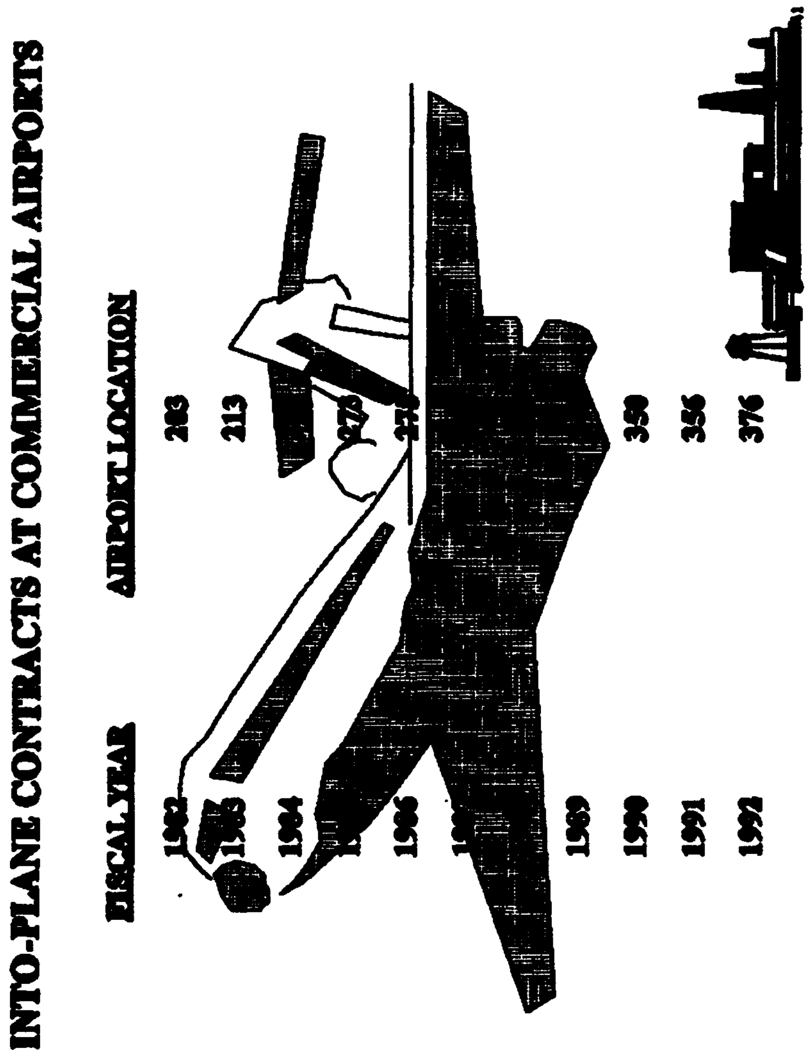
APPENDIX B - SPECIALTY FUELS DIVISION



(DFSC, 1992, p. 39)

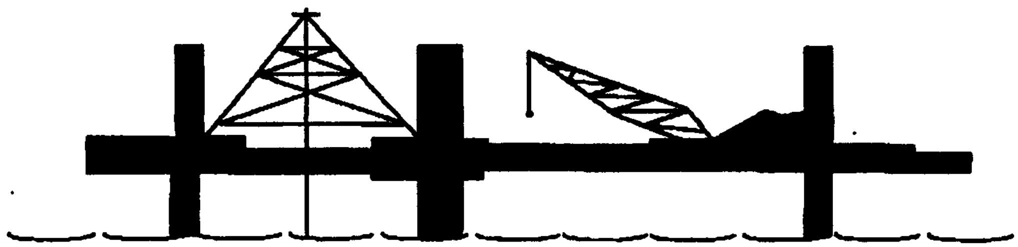


(DFSC, 1992, p. 40)



(DFSC, 1992, p. 41)

SHIP'S BUNKERS PROGRAM
FY 92



- <u>DOMESTIC (AWARDED)</u>
  - 66 LOCATIONS
  - $37.1 MILLION
  - 2.02 MILLION BBLS

- <u>OVERSEAS (AWARDED)</u>
  - 6 LOCATIONS
  - 5 COUNTRIES
  - $5.89 MILLION
  - .038 MILLION BBLS

42

APPENDIX C - NATURAL GAS DIVISION

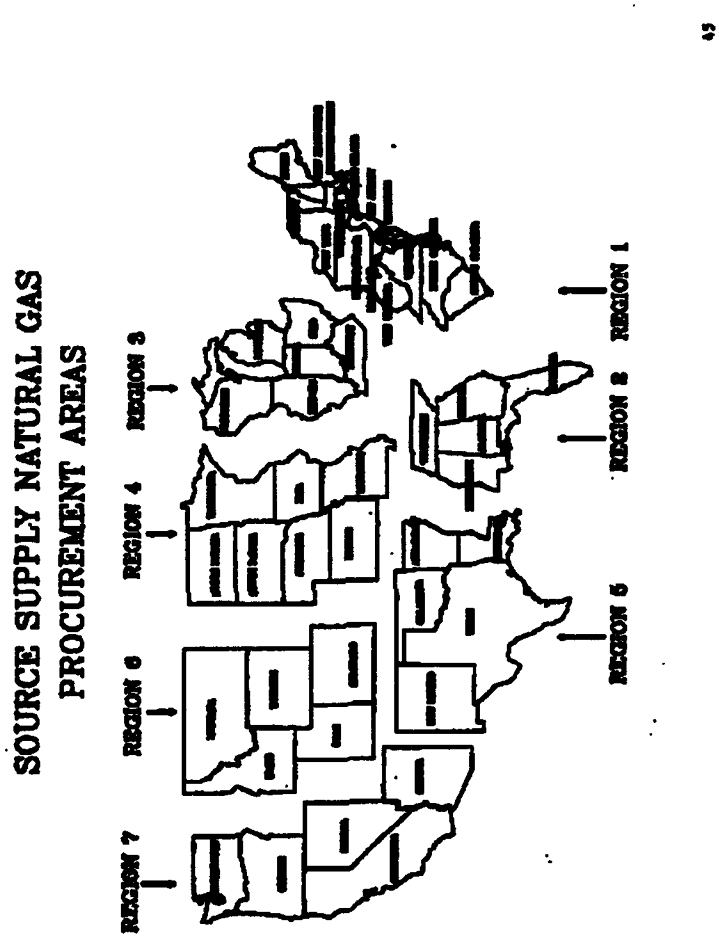
NATURAL GAS DIVISION

(DFSC, 1992, p. 43)

NATURAL GAS DIVISION

- DLA TASKED WITH DoD MISSION - SEP 89
- $15.3 MILLION IN SAVINGS SINCE OCT 90
- FEDERAL/CIVILIAN AGENCIES INCLUDED UPON REQUEST
- NEGOTIATED PROCUREMENTS - REGION BY REGION
- PRIMARILY SMALL BUSINESS SET - ASIDES

(DFSC, 1992, p. 44)

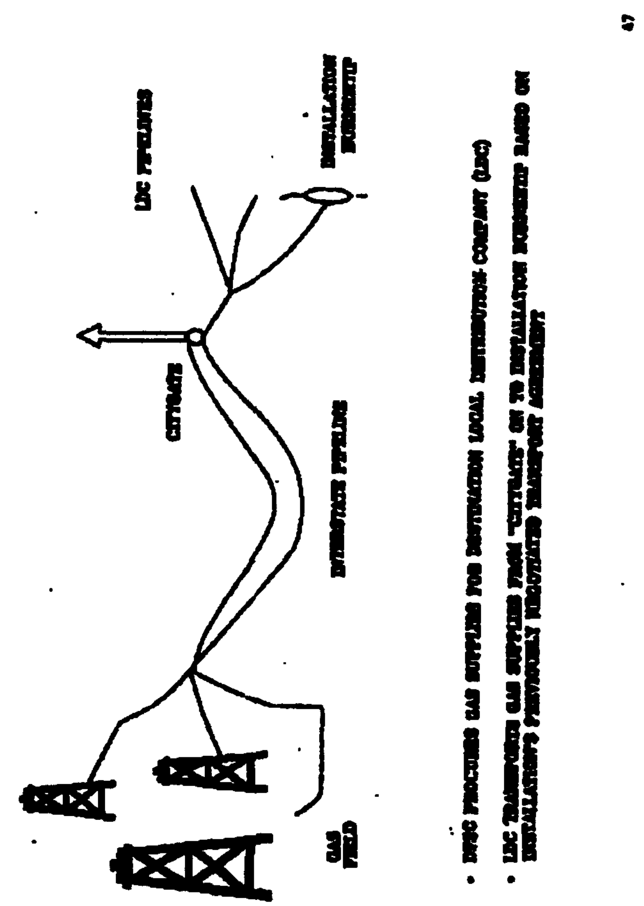


(DFSC, 1992, p. 45)

NATURAL GAS
FY 1992

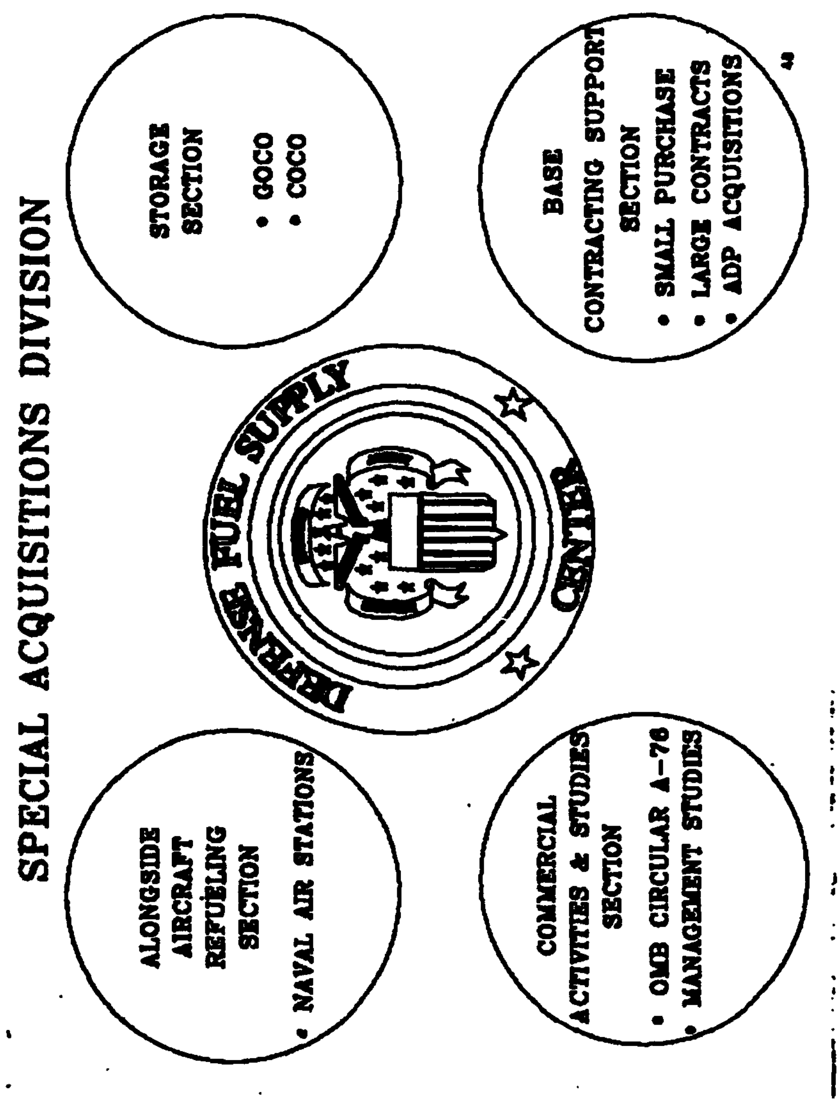
REGION	DEKATHERMS AWARDED	TOTAL DOLLARS AWARDED
1	3,640,157	$ 8,899,182
2	324,182	$ 660,114
3	577,730	$ 1,183,852
4	6,616,265	$12,199,443
5	6,908,915	$12,947,995
6	3,297,443	$ 4,969,978
7	8,965,512	$ 4,541,324
TOTALS	30,360,204	$45,401,888

(DFSC, 1992, p. 47)

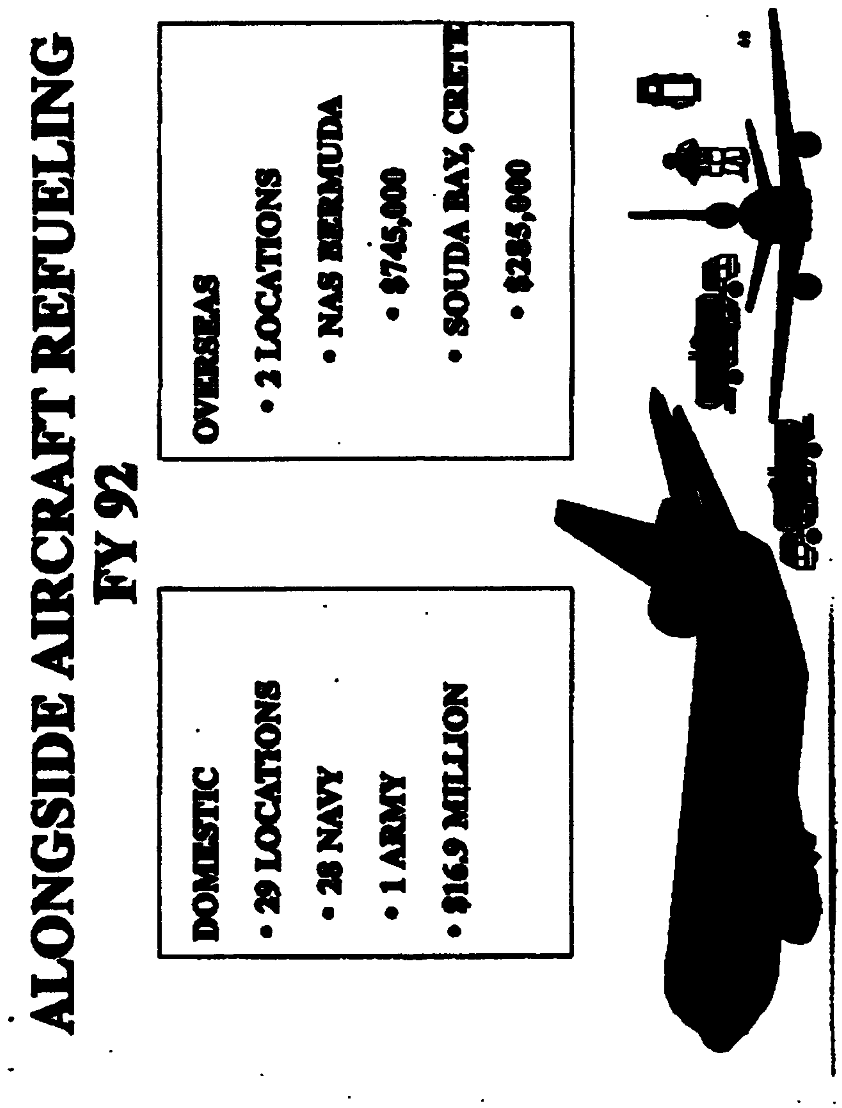


(DFSC, 1992, p. 47)

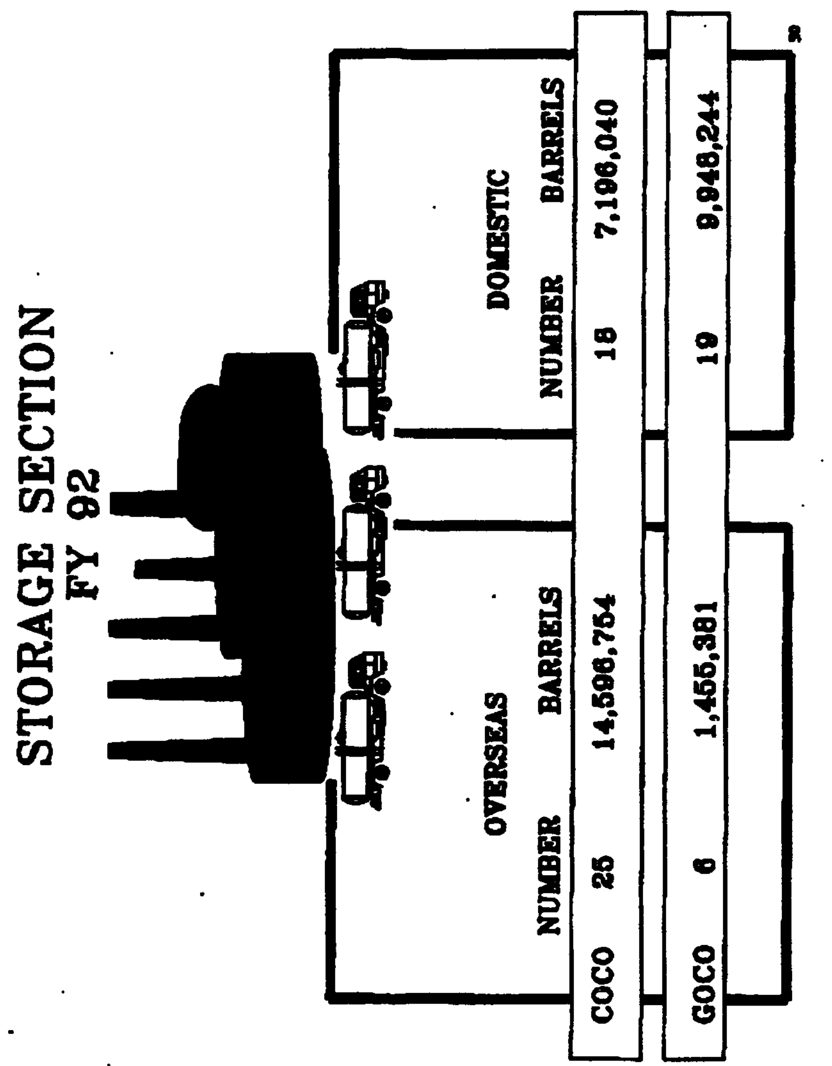
APPENDIX D - SPECIALTY ACQUISITIONS DIVISION



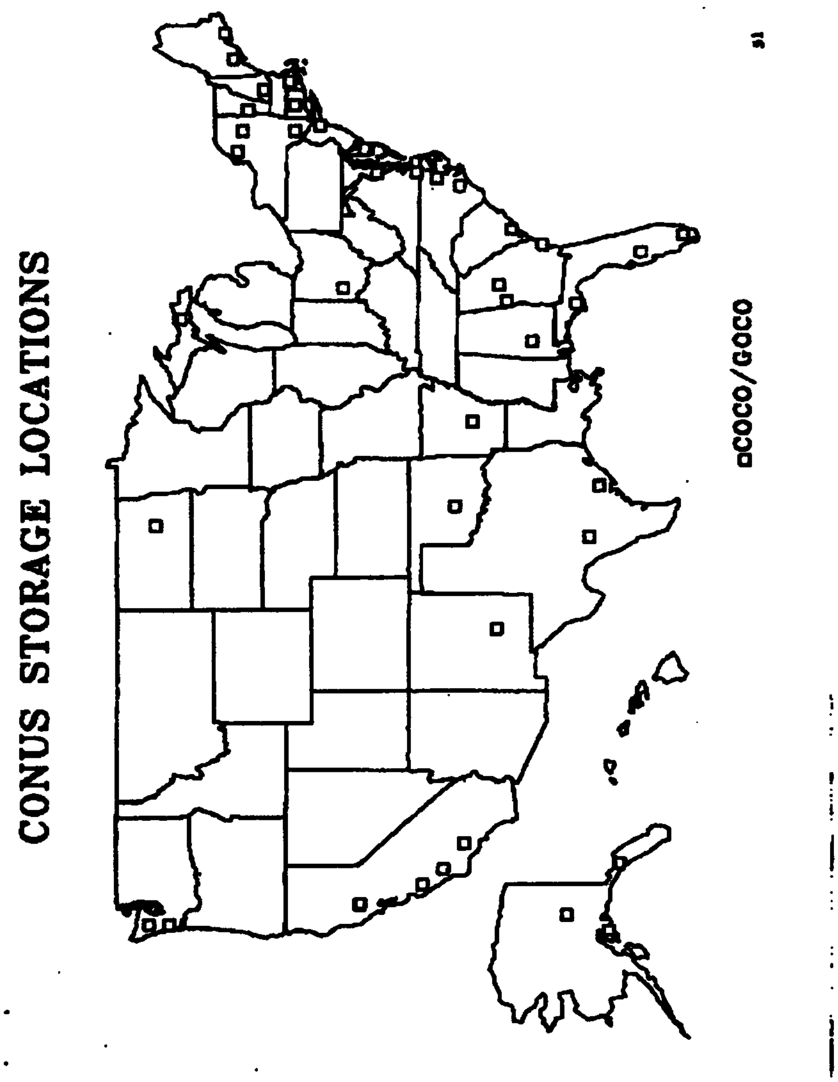
(DFSC, 1992, p. 48)



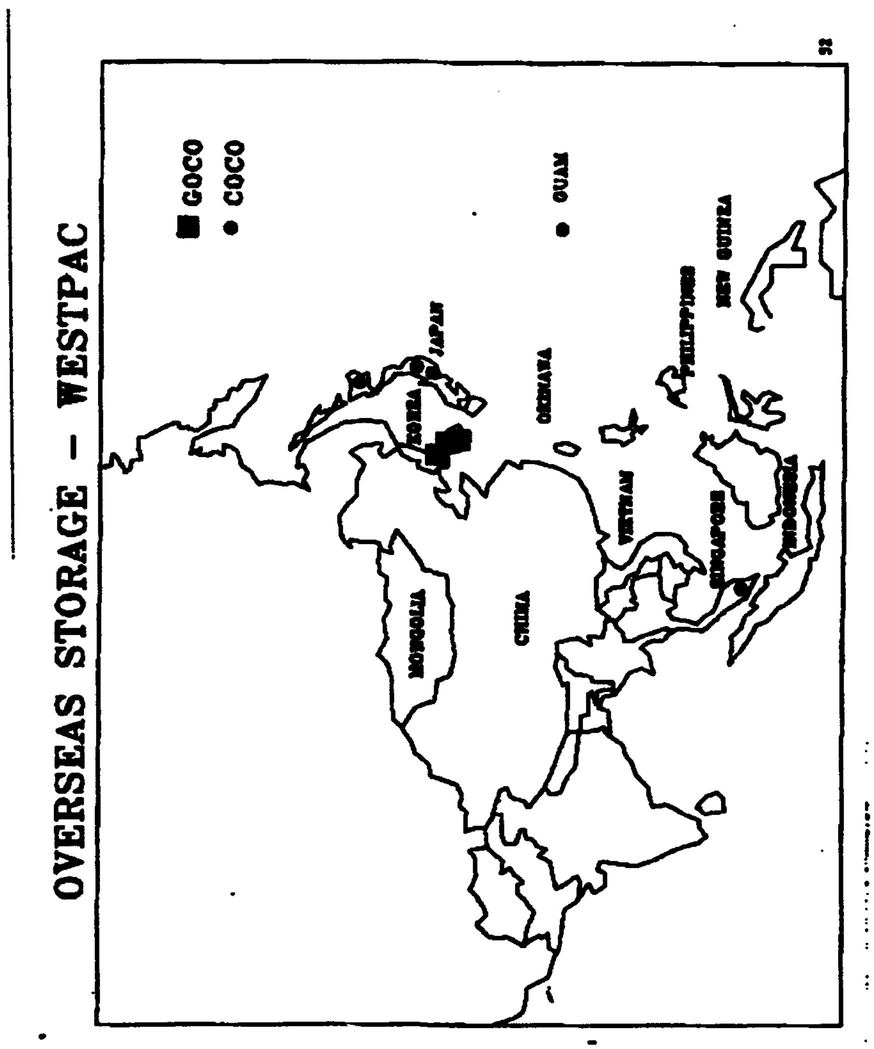
(DFSC, 1992, p. 49)



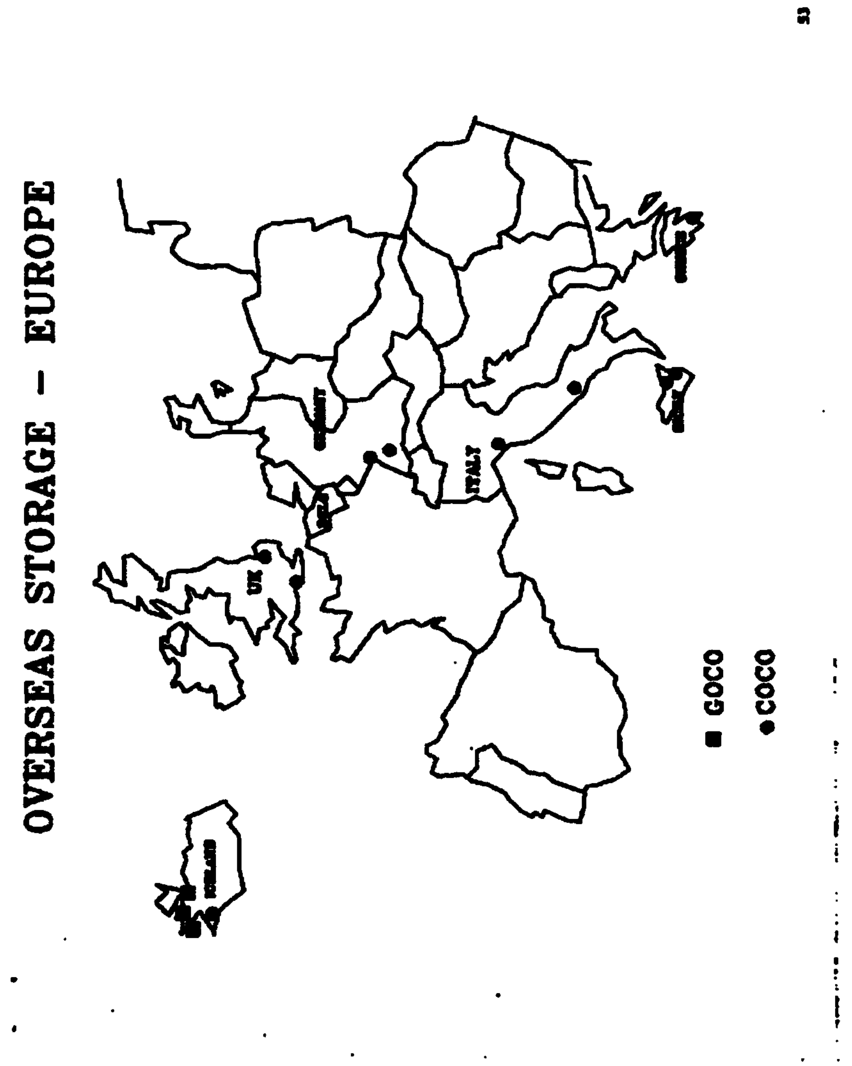
(DFSC, 1992, p. 50)



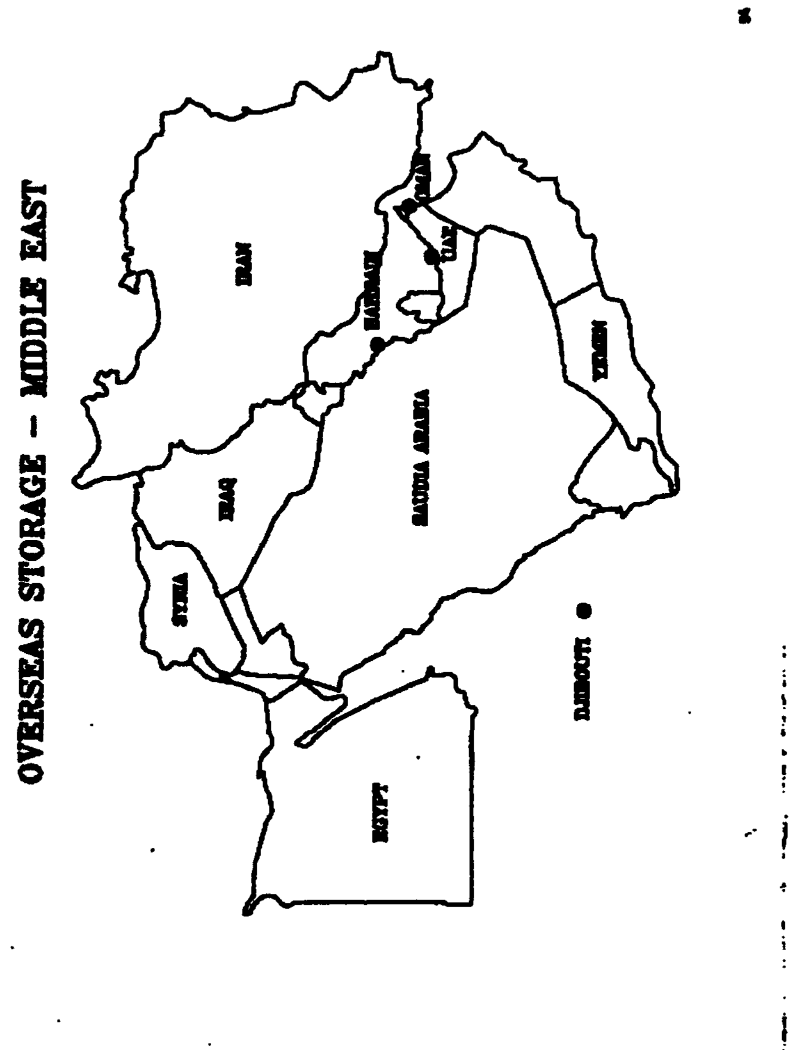
(DFSC, 1992, p. 51)



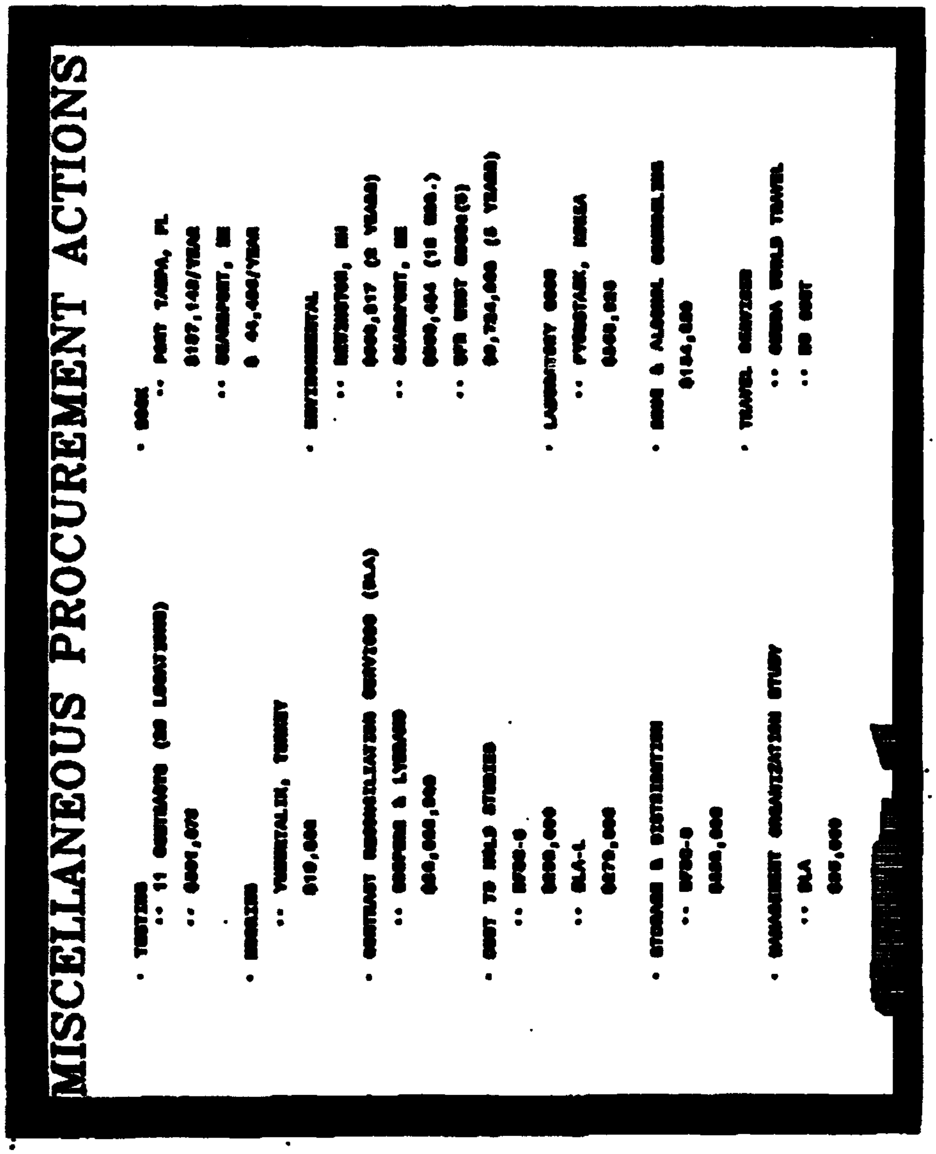
(DFSC, 1992, p. 52)



(DFSC, 1992, p. 53)



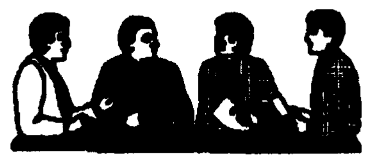
(DFSC, 1992, p. 54.)



(DFSC, 1992, p. 55)

SPECIAL ACQUISITIONS DIVISION
FY 92

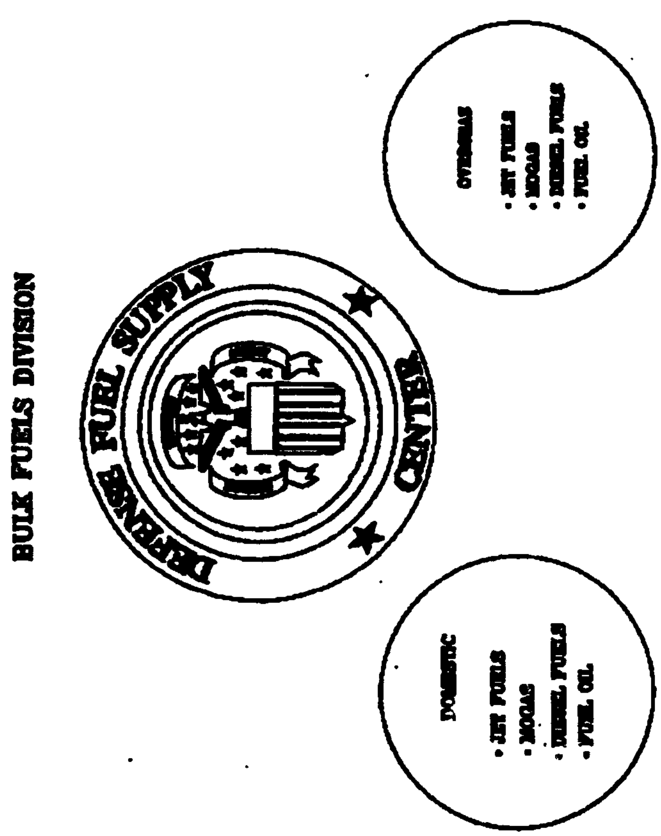
BASE CONTRACTING SUPPORT
(SMALL PURCHASES)



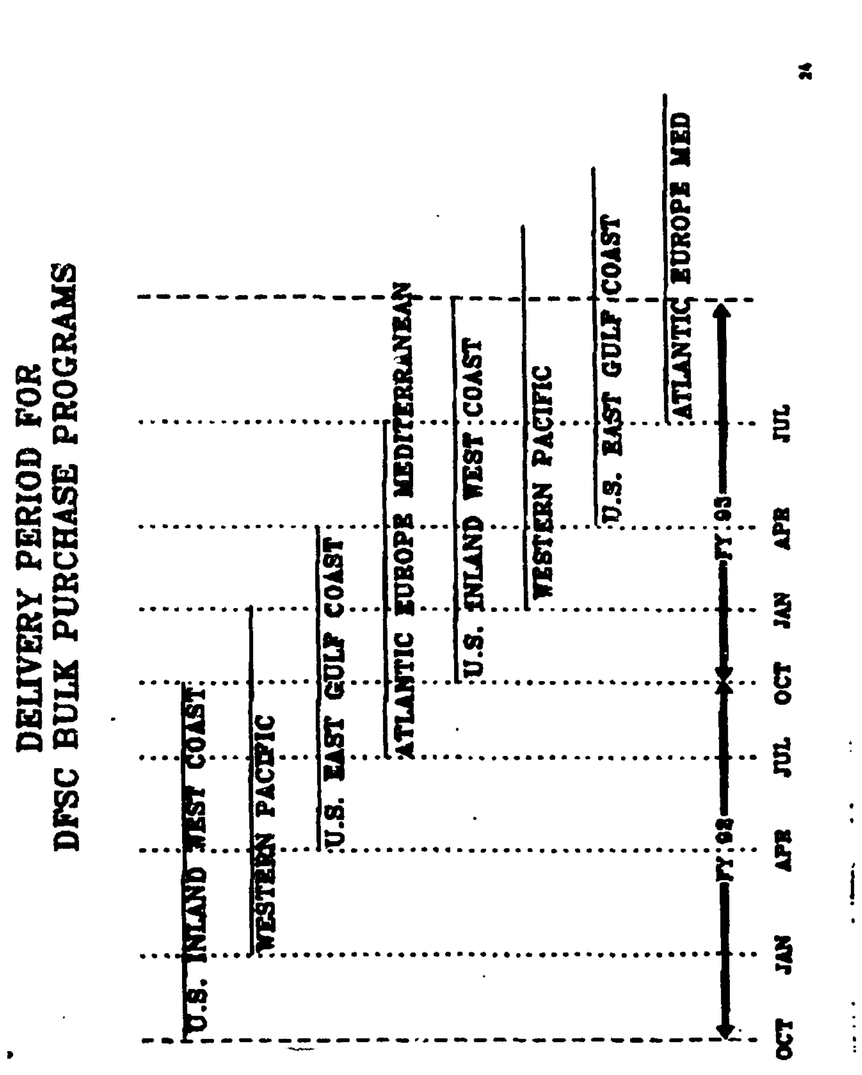
- **28 OFFICES/ACTIVITIES SUPPORTED**
- **2,900 EMPLOYEES SUPPORTED**
- **7,122 REQUIREMENTS AWARDED**
- **$7,482,000 OBLIGATED**

(DFSC, 1992, p. 56)

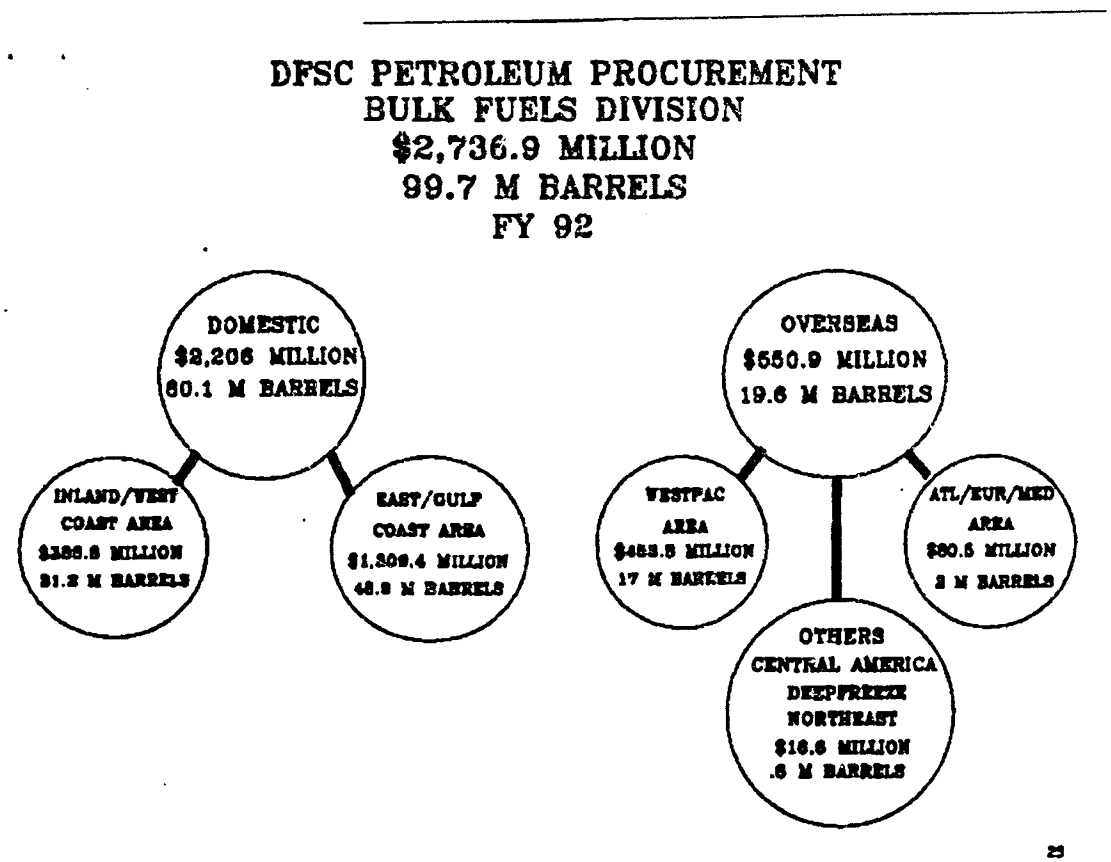
APPENDIX E - BULK FUELS DIVISION



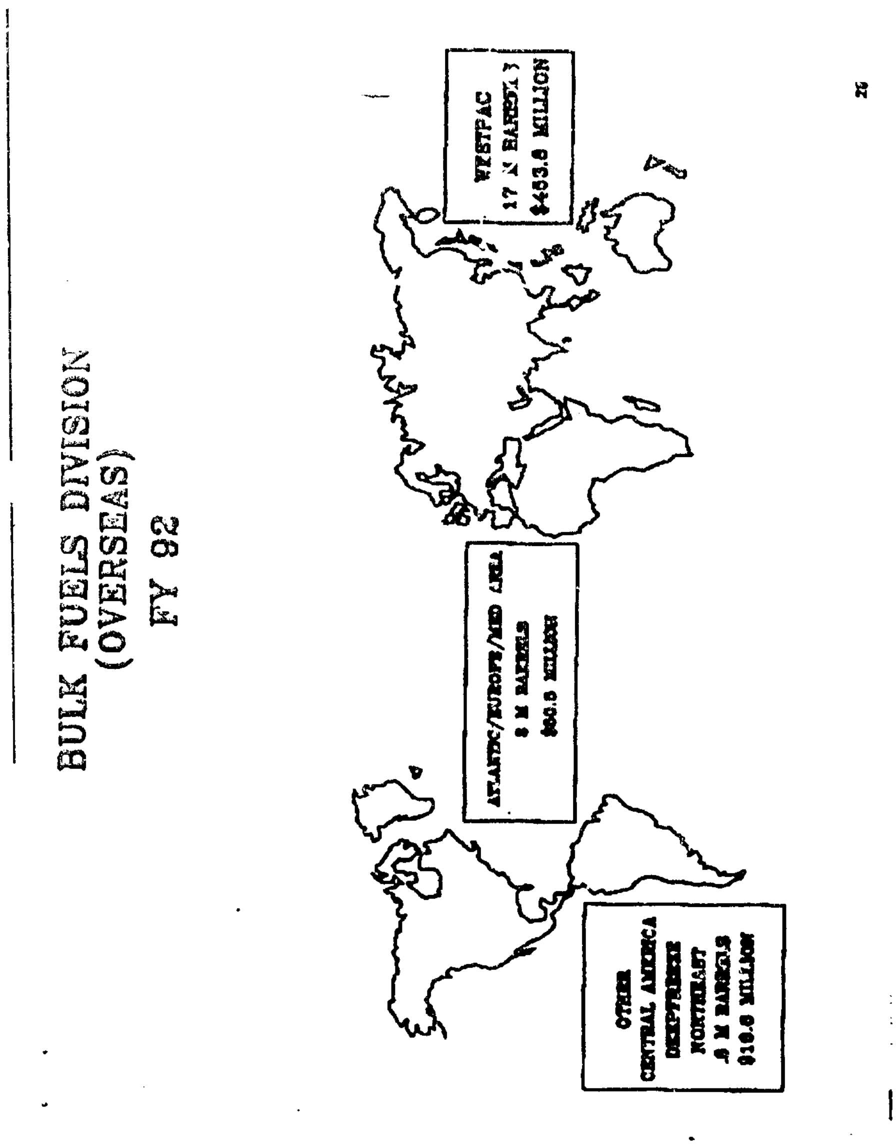
(DFSC, 1992, p. 23)



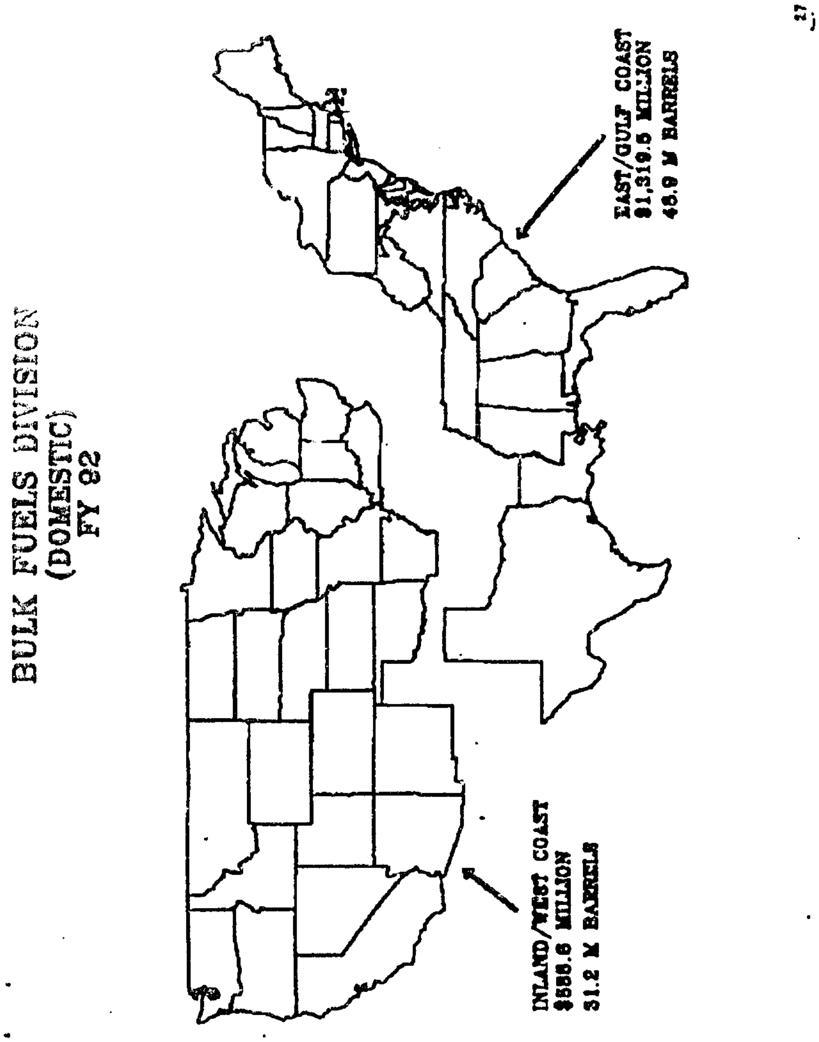
(DFSC, 1992, p. 24)



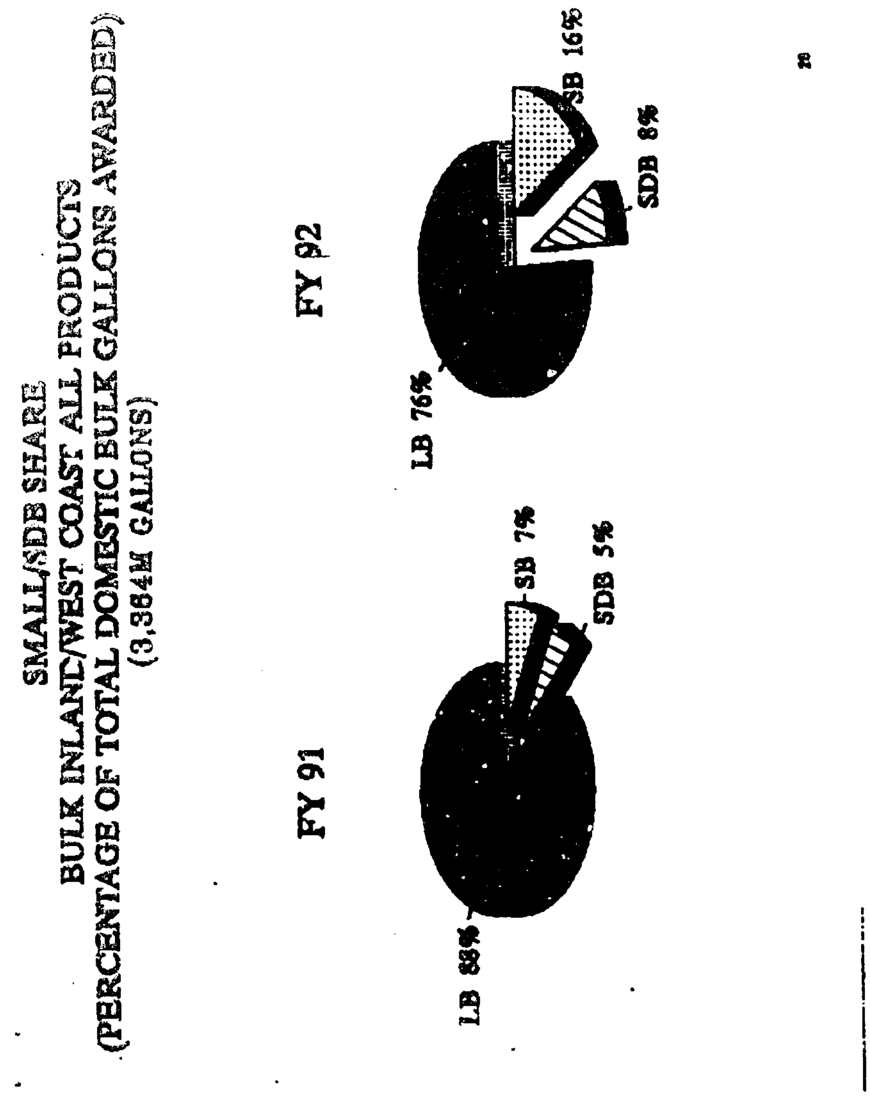
(DFSC, 1992, p. 25)



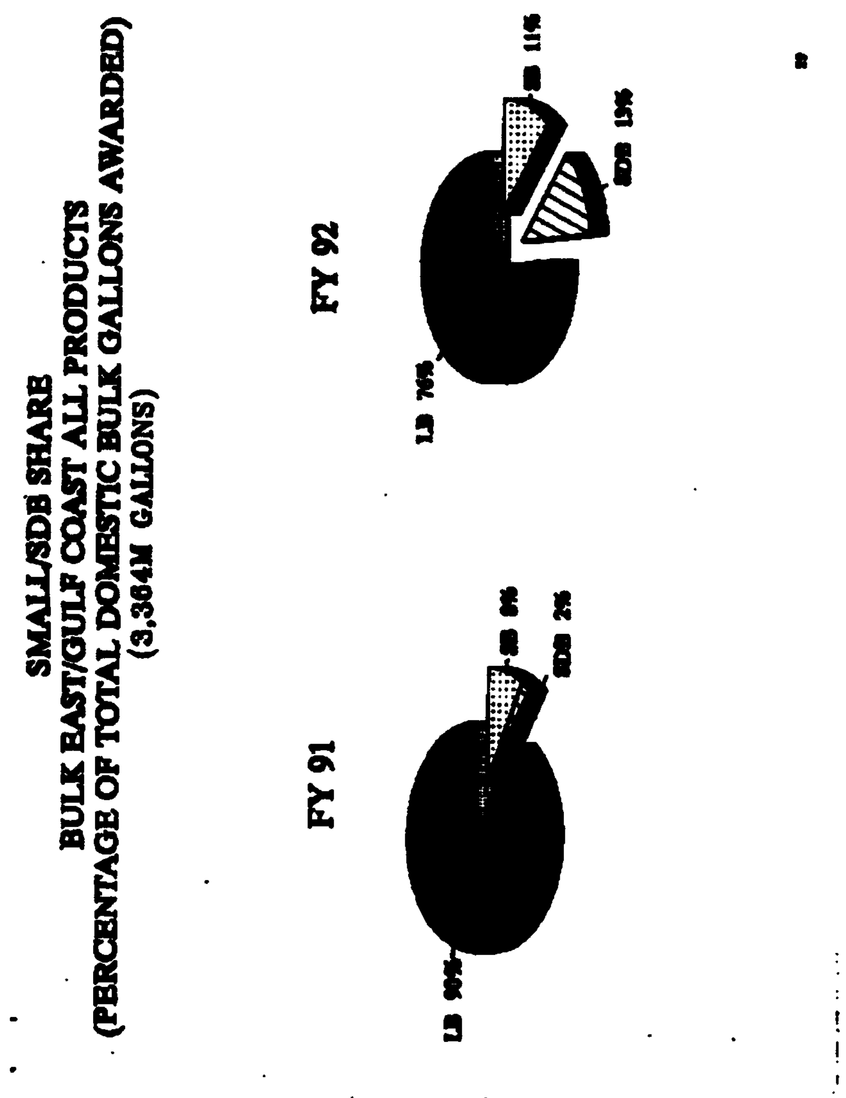
(DFSC, 1992, p. 26)



(DFSC, 1992, p. 27)



(DFSC, 1992, p. 28)



(DFSC, 1992, p. 29)

APPENDIX F - GLOSSARY OF TERMS

Account Executive – The agent of a commission house who serves customers/traders by entering their commodity futures and options orders, reporting trade executions, advising on trading strategies, etc.

Actuals – Physical cash commodities as opposed to futures contracts.

ADP – Alternative Delivery Procedure. A provision of a futures contract that allows buyers and sellers to make and take delivery under terms or conditions that differ from those prescribed in the contract. An ADP may occur at any time during the delivery period, once long and short futures positions have been matched for the purpose of delivery.

Administrative Workstation – A NYMEX ACCESS℠ workstation through which NYMEX Clearing Members monitor all activity in accounts they carry and set limits on their customers' accounts through the Trade Limit Monitoring System.

All or None – An order which must be filled in its entirety or not at all.

American Option – An option contract that may be exercised at any time prior to expiration. This differs from a "European option," which may only be exercised on the expiration date. NYMEX options are "American."

API – American Petroleum Institute. The primary U.S. oil industry trade association; based in Washington, D.C.

API Gravity – Gravity (weight per unit volume) of oils as measured by the API scale whereby:

$$\text{API Gravity} = \frac{141.5}{\text{specific gravity at } 60^\circ F} - 131.5$$

Arbitrage – The simultaneous purchase of one commodity against the sale of another in order to profit from fluctuations in the usual price relationships. Variations include the simultaneous purchase and sale of different delivery months of the same commodity; of the same delivery month, but different grades of the same commodity; and of different commodities.

Ask – A motion to sell. The same as Offer.

Assay – To test a metal or an oil for purity or quality.

Assignment – The process by which the seller of an option is notified of a buyer's intention to exercise the rights associated with the option.

Associated Gas – Natural gas present in a crude oil reservoir, either separate from or in solution with the oil.

ASTM – American Society for Testing Materials. Grade and quality specifications for petroleum products are determined by ASTM in test methods.

At-the-Market – An order to buy or sell a futures contract at whatever price is obtainable when the order reaches the trading floor. Also called a Market Order.

At-the-Money – An option whose exercise, or strike, price is closest to the futures price.

Avoirdupois unit – Customary U.S. weights. 1 troy ounce = 1.09 ounces avoirdupois.

Automatic Exercise – Following option expiration, an option which is in-the-money by $100 or more is exercised automatically by the clearing house, unless the holder of the option submits specific instructions to the contrary.

Backwardation – Market situation in which futures prices are lower in each succeeding delivery month. Also known as an Inverted Market. The opposite of Contango.

Banker's Acceptance – A draft or bill of exchange accepted by a bank; payment is guaranteed by the accepting institution.

Barge – A vessel, either motorized or towed, used to carry products in navigable waterways. Inland river barges that carry oil products generally hold 25,000 barrels. Ocean-going barges range in size up to 120,000 barrels.

Barrel – A unit of volume measure used for petroleum and refined products. 1 barrel = 42 U.S. gallons.

Basis – The differential that exists at any time between the cash, or spot price of a given commodity and the price of the nearest futures contract for the same or a related commodity. Basis may reflect different time periods, product forms, qualities or locations. Cash minus Futures equals Basis.

Basis Risk – The uncertainty as to whether the cash-futures spread will widen or narrow between

(NYMEX, December 1992, pp. 2-3)

the time a hedge position is implemented and liquidated.

Batch – A measured amount in which crude oil and refined product shipments are sent through a pipeline.

Batching Sequence – The order in which shipments are sent through a pipeline.

Bcf – Billion cubic feet.

B/D – Barrels per Day. Usually used to quantify a refiner's output capacity or an oilfield's rate of flow.

Bear – One who anticipates a decline in price or volatility. Opposite of a Bull.

Bear Spread – 1) The simultaneous purchase and sale of two futures contracts in the same or related commodities with the intention of profiting from a decline in prices, but at the same time limiting the potential loss if this expectation is wrong. This can usually be accomplished by selling a nearby delivery and buying a deferred delivery. 2) A delta-negative option position comprised of long and short options of the same type, either calls or puts, designed to be profitable in a declining market. An option with a lower strike price is sold and one with a higher strike price is bought.

Bid – A motion to buy a futures or option contract at a specified price. Opposite of Offer.

Black-Scholes Model – An option pricing formula initially derived by Fisher Black and Myron Scholes for securities options and later refined by Black for options on futures.

Boiler Room – An enterprise which often is operated out of inexpensive, low-rent quarters that uses high pressure sales tactics, generally over the telephone, and possibly false or misleading information to solicit generally unsophisticated investors.

Book Transfer – Transfer of title without actually delivering the product.

Box Spread – An option market arbitrage in which both a bull spread and a bear spread are established for a riskless profit. One spread includes put options and the other includes calls.

Break – A rapid and sharp price decline.

Breakeven Point – The underlying futures price at which a given option strategy is neither profitable nor unprofitable. For call options, it is the strike price plus the premium. For put options, it is the strike price minus the premium.

British Thermal Unit – The amount of heat required to increase the temperature of a pound of water 1° Fahrenheit. A Btu is used as a common measure of heating value for different fuels. Prices of different fuels and their units of measure (dollars per barrel of crude, dollars per ton of coal, cents per gallon of gasoline, cents per thousand cubic feet of natural gas) can be easily compared when expressed as dollars and cents per million Btus.

Broker – 1) An individual who is paid a fee or commission for acting as an agent in making contracts, sales, or purchases. 2) A Floor Broker is a person who actually executes trading orders on the floor of an exchange. 3) An Account Executive, Registered Commodity Representative, or Customers' Man who deals with customers and their orders in commission house offices. See also Futures Commission Merchant.

BS&W – Bottom sediment and water, often found in crude oil and residual fuel.

Btu – See British thermal unit.

Bulge – A rapid advance in futures prices.

Bull – One who anticipates an increase in price or volatility. Opposite of a Bear.

Bull Spread – 1) The simultaneous purchase and sale of two futures contracts in the same or related commodities with the intention of profiting from a rise in prices but at the same time limiting the potential loss if this expectation is wrong. This can be accomplished by buying the nearby delivery and selling the deferred. 2) A delta-positive option position composed of both long and short options of the same type, either calls or puts, designed to be profitable in a rising market. An option with a lower strike price is bought and one with a higher strike price is sold.

Bunker C Fuel Oil – (or bunkering fuel) Fuel used for ships. Generally refers to a No. 6 grade of residual fuel oil with an API gravity about 10.5°.

Buyer's Market – A condition of the market in which there is an abundance of goods available

4 5

(NYMEX, December 1992, pp. 4-5)

and hence buyers can afford to be selective and may be able to buy at less than the price that had previously prevailed. See Seller's Market.

Buying Hedge – Also called a long hedge. Buying futures contracts to protect against possible increased costs of commodities that will be needed in the future.

Calendar Spread – An option position comprised of the purchase and sale of two option contracts of the same type that have the same strike prices but different expiration dates. Also known as a Horizontal, or Time, Spread.

Call Option – An option that gives the buyer (holder) the right, but not the obligation, to buy a futures contract (enter into a long futures position) for a specified price within a specified period of time in exchange for a one-time premium payment. It obligates the seller (writer) of an option to sell the underlying futures contract (enter into a short futures position) at the designated price, should the option be exercised at that price.

Cap – A supply contract between a buyer and seller, whereby the buyer is assured that he will not have to pay more than a given maximum price. This type of contract is analogous to a call option.

Carrying Charge – The total cost of storing a physical commodity over a period of time. Includes storage charges, insurance, interest, and opportunity costs.

Cash Commodity – The actual, physical commodity. Sometimes called a Spot Commodity or Actuals.

Cash Market – The market for a cash commodity where the actual physical product is traded.

Casinghead Gas – Gas present in an oil well that is removed when it flows to the surface at the well's casing.

Cetane Number – A measure of the ignitability of diesel fuel. Diesel fuel generally has to meet a cetane number specification of 40. As a measure of performance, the cetane number serves a similar purpose as does the octane number of gasoline.

CFPD – Cubic feet per day. Usually used to quantify the rate of flow of a gas well or pipeline.

CFTC – See Commodity Futures Trading Commission.

Charting – The use of graphs and charts in the analysis of market behavior, so as to plot trends of price movements, average movements of price, volume, and open interest, in the hope that such graphs and charts will help one to anticipate and profit from price trends. Contrasts with Fundamental Analysis.

CIF – Cost, Insurance, Freight. Term refers to a sale in which the buyer agrees to pay a unit price that includes the free on board (FOB) value at the port of origin plus all costs of insurance and transportation. This type of transaction differs from a "delivered" agreement in that it is generally ex-duty, and the buyer accepts the quantity and quality at the loading port rather than pay on quality and quantity as determined at the unloading port. Risk and title are transferred from the seller to the buyer at the loading port, although the seller is obliged to provide insurance in a transferable policy at the time of loading.

City Gate – Generally refers to the location at which gas changes ownership or transportation responsibility from a pipeline to a local distribution company or gas utility.

Class of Options – All call options, or all put options, exercisable for the same underlying futures contract and which expire on the same expiration date.

Class of Service – A utility's sales categories such as residential, commercial, industrial, other, and sales for resale.

Clean Cargo – Refined products such as kerosene, gasoline, home heating oil, jet fuel carried by tankers, barges and tank cars. All refined products except bunker fuels, residual fuel oil, asphalt and coke.

Clearing Member – Clearing Members of the New York Mercantile Exchange accept responsibility for all trades cleared through them, and share secondary responsibility for the liquidity of the Exchange's clearing operation. They earn commissions for clearing their customers' trades, and enjoy special margin privileges. Original margin requirements for Clearing Members are lower

NYMEX, December 1992, pp. 6-7)

them for customers, and Clearing Members may use letters of credit posted with the clearinghouse as original margin for customer accounts as well as for their own trades. Clearing Members must meet minimum capital requirements.

Clearinghouse – An exchange-associated body charged with the function of insuring the financial integrity of each trade. Orders are "cleared" by means of the clearinghouse acting as the buyer to all sellers and the seller to all buyers.

Closing Range – A range of prices at which transactions took place at the closing of the market; buying and selling orders at the closing might have been filled at any point within such a range.

Collar – A supply contract between a buyer and seller of a commodity, whereby the buyer is assured that he will not have to pay more than some maximum price, and whereby the seller is assured of receiving some minimum price. This is analogous to an option fence, also known as a range forward.

Combination Utility – A utility which provides both gas and electric service.

Commission – The fee charged by a futures broker for the execution of an order.

Commission House – An organization that trades commodities and/or futures and options contracts for customer accounts in return for a fee.

Commission Merchant – One who makes a trade, either for another member of an exchange or for a nonmember client, but who makes the trade in his own name and becomes liable as principal to the other.

Commitment or Open Interest – The number of open or outstanding contracts for which an individual or entity is obligated to the Exchange because that individual or entity has not yet made an offsetting sale or purchase, an actual contract delivery, or, in the case of options, exercised the option.

Commodity – As defined by the CFTC, specifically enumerated agricultural commodities, all other goods and articles, except onions, and all services, rights and interests in which contracts for future delivery are presently, or in the future may be, dealt.

Commodity Futures Trading Commission – A federal regulatory agency authorized under the Commodity Futures Trading Commission Act of 1974 to regulate futures trading in all commodities. The commission is comprised of five commissioners, one of whom is designated as chairman, all appointed by the President, subject to Senate confirmation. The CFTC is independent of the Cabinet departments.

Contango Market – A market situation in which prices are higher in the succeeding delivery months than in the nearest delivery month. Opposite of Backwardation.

Contingency Order – An order which becomes effective only upon the fulfillment of some condition in the marketplace.

Contract – 1) A term of reference describing a unit of trading for a commodity future or option. 2) An agreement to buy or sell a specified commodity, detailing the amount and grade of the product and the date on which the contract will mature and become deliverable.

Contract Grade – That grade of product established in the rules of a commodity futures exchange as being suitable for delivery against a futures contract.

Contract Months – See Delivery Month.

Contract Trading Volume – Daily trading volume

Conversion – A delta-neutral arbitrage transaction involving a long futures, a long put option, and a short call option. The put and call options have the same strike price and same expiration date.

Cover – To close out a short futures or option position.

Covered Writing – The sale of an option against an existing position in the underlying futures contract. For example, short call and long futures.

Crack Spreads – The simultaneous purchase or sale of crude against the sale or purchase of products. These spread differentials which represent refining margins are normally quoted in dollars per barrel by converting the product prices into dollars per barrel and subtracting the crude price from the average product prices.

Crude Oil – A mixture of hydrocarbons that exists as a liquid in natural underground reservoirs and

(NYMEX, December 1992, pp. 8-9)

remains liquid at atmospheric pressure after passing through surface separating facilities. Crude is the raw material which is refined into gasoline, heating oil, jet fuel, propane, petrochemicals and other products.

Cubic Foot – The most common measure of gas volume, referring to the amount of gas needed to fill a volume of one cubic foot at 14.73 pounds per square inch absolute pressure and 60° Fahrenheit. One cubic foot of natural gas contains, on average, 1,027 Btus.

Current Delivery Month – The futures contract which matures and becomes deliverable during the present month or the month closest to delivery. Also called the Spot Month.

Cushion Gas – The amount of gas required in a storage pool to maintain sufficient pressure to keep the working gas recoverable.

Day Trade – The purchase and sale of a futures or an option contract on the same day.

Dealer Tank Wagon Price – (DTW) The price, usually of gasoline, offered by the majors which is branded and delivered to the service station on a CIF basis.

Degree Day – A measure of the coldness of the weather (heating degree day) or its heat (cooling degree day) based on the extent to which the daily mean temperature falls below or rises above 65° Fahrenheit.

Delivered – Often regarded as synonymous with CIF in the international cargo trade, its terms differ from the latter in a number of ways. Generally, the seller's risks are greater in a delivered transaction because the buyer pays on the basis of landed quality/quantity. Risk and title are borne by the seller until such time as the commodity, such as oil, passes from shipboard into the connecting flange of the buyer's shore installation. The seller is responsible for clearance through customs and payment of all duties. Any in-transit contamination or loss of cargo is the seller's liability. In delivered transactions the buyer pays only for the quantity of oil actually received in storage.

Delivery – The term has distinct meaning when used in connection with futures contracts.

Delivery generally refers to the changing of ownership or control of a commodity under specific terms and procedures established by the exchange upon which the contract is traded. Typically, except for energy, the commodity must be placed in an approved warehouse, precious metals depository or other storage facility, and be inspected by approved personnel, after which the facility issues a warehouse receipt, shipping certificate, demand certificate or due bill, which becomes a transferable delivery instrument. Delivery of the instrument usually is preceded by a notice of intention to deliver. After receipt of the delivery instrument, the new owner typically can take possession of the physical commodity, can deliver the delivery instrument into the futures market in satisfaction of a short position, or can sell the delivery instrument to another market participant who can use it for delivery into the futures market in satisfaction of his short position or for cash, or can take delivery of the physical himself.

The procedure differs for energy contracts. Bona fide buyers or sellers of the underlying energy commodity can stand for delivery. If a buyer or seller stands for delivery, the contract is held through the termination of trading. The buyer and seller each file a notice of intent to make or take delivery with their respective Clearing Members who file them with the Exchange. Buyers and sellers are randomly matched by the Exchange. The delivery payment is based on the contract's final settlement price.

Delivery Month – The month specified in a given futures contract for delivery of the actual physical spot or cash commodity.

Delivery Notice – A notice presented through an exchange's clearing house by a clearing member announcing the intention to deliver the actual commodity in satisfaction of a contract obligation.

Delivery Point(s) – Location(s) designated by an exchange at which delivery may be made in fulfillment of contract terms.

Delta – The sensitivity of an option's value to a change in the price of the underlying futures contract, also referred to as an option's futures-equivalent position. Deltas are positive for bullish option positions, or calls, and negative for bearish option

(NYMEX, December 1992, pp. 10-11)

214

D

positions, or puts. Deltas of deep in-the-money options are approximately equal to one; deltas of at-the-money options are 0.5; and deltas of deep out-of-the-money options approach zero.

Delta Neutral Spread – A spread where the total delta position on the long side and the total delta on the short side add up to approximately zero.

Depository or Warehouse Receipt – A document issued by a bank or warehouse indicating ownership of a commodity stored in a bank depository or warehouse. In the case of many commodities deliverable against futures contracts, transfer of ownership of an appropriate depository receipt may effect contract delivery.

Diesel Fuel – Distillate fuel oil used in compression-ignition engines. It is similar to home heating oil, but must meet a cetane number specification of 40 or more. See Cetane.

Differentials – Price differences between classes, grades and locations of different stocks of the same commodity.

Dirty Cargo – Those petroleum products which leave significant amounts of residue in tanks. Generally applies to crude oil and residual fuel oil.

Discount – 1) A downward adjustment in price allowed for delivery of stocks of a commodity of lesser than contract grade against a futures contract. 2) Sometimes used to refer to the price differences between futures of different delivery months.

Distillate Fuel Oil – Products of refinery distillation sometimes referred to as middle distillates; kerosene, diesel fuel, and home heating oil.

Doctor Test – A qualitative method of detecting undesirable sulfur compounds in petroleum distillates; that is, determining whether an oil is sour or sweet.

Downstream – An industry term referring to commercial oil and gas operations beyond the production phase; oil refining and marketing, and natural gas transmission and distribution.

Dry Gas – Gas that does not contain liquid hydrocarbons.

E

EFP – see Exchange of Futures for Physicals.

Electronic Trader – A person who is authorized to enter orders for his own account and/or for customers' accounts on the NYMEX ACCESS℠ electronic trading system.

End-User – The ultimate consumer of petroleum products or natural gas; most commonly refers to large commercial, industrial, or utility consumers.

European Option – An option that may be exercised only on its expiration date.

Exchange Certified Stocks – Stocks of commodities held in depositories or warehouses certified by an Exchange approved inspection authority as constituting good delivery against a futures contract position. Current total certified stocks are reported in the press for many important commodities such as platinum.

Exchange of Futures for Cash – A transaction in which the buyer of a cash commodity transfers to the seller a corresponding amount of long futures contracts, or receives from the seller a corresponding amount of short futures, at a price difference mutually agreed upon. In this way, the opposite hedges in futures of both parties are closed out simultaneously.

Exchange of Futures for Physicals – A futures contract provision involving an agreement for delivery of physical product that does not necessarily conform to contract specifications in all terms from one market participant to another and a concomitant assumption of equal and opposite futures positions by the same participants at the time of the agreement.

Exercise – The process of converting an options contract into a futures position.

Exercise Price – The price at which the underlying futures contract will be bought or sold in the event an option is exercised. Also called the strike price.

Expiration Date – The date and time after which trading in options terminates, and after which all contract rights or obligations become null and void.

Extrinsic Value – The amount by which the premium exceeds its intrinsic value. Also known as time value.

(NYMEX, December 1992, pp. 12-13)

Fair Value – Theoretical value.

Fast Market – Transactions in the pit or ring that take place in such volume and with such rapidity that price reporters are behind with price quotations, so they insert "Fast" and show a range of prices.

Feedstock – The supply of crude oil, natural gas liquids, or natural gas to a refinery or petrochemical plant or the supply of some refined fraction of intermediate product to some other manufacturing process.

Fence – A long (short) underlying position together with a long (short) out-of-the-money put and a short (long) out-of-the-money call. All options must expire at the same time.

FIA – Futures Industry Association. A national not-for-profit futures industry trade association that represents the brokerage community on industry, regulatory, political and educational issues.

Fill or Kill – An order which must be filled immediately, and in its entirety. Failing this, the order will be cancelled.

Fineness – The measure of the proportion of pure metal, usually refers to precious metals such as platinum, palladium, gold and silver.

Firm Service – Utility service which assumes no interruption except if residential customers' supply is threatened. Opposite of Interruptible Service.

First Notice Day – The first day on which the Clearing House notifies Clearing Members of delivery allocations. Energy contracts have only one notice day.

Floor – 1) The main trading area of an exchange. 2) A supply contract between a buyer and seller of a commodity, whereby the seller is assured that he will received at least some minimum price. This type of contract is analogous to a put option.

Floor Broker – An exchange member who executes orders to buy or sell futures and options in the trading ring on the floor of a commodities exchange.

Floor Trader or Local – An exchange member who executes orders to buy or sell futures and options for his own account.

Force Majeure – A standard clause which indemnifies either or both parties to a transaction whenever events which the Exchange declares to be reasonably beyond the control of either party occur to prevent fulfillment of the terms of the contract.

Forward Contract – A supply contract between a buyer and seller, whereby the buyer is obligated to take delivery and the seller is obligated to provide delivery of a fixed amount of a commodity at a predetermined price on a specified future date. Payment in full is due at the time of, or following, delivery. This differs from a futures contract where settlement is made daily, resulting in partial payment over the life of the contract.

Fractionation – The process whereby saturated hydrocarbons from natural gas are separated into distinct parts or "fractions" such as propane, butane, ethane, etc.

Free on Board (FOB) – A transaction in which the seller provides a commodity at an agreed unit price, at a specified loading point within a specified period; it is the responsibility of the buyer to arrange for transportation and insurance.

Fuel Oil – Refined petroleum products used as a fuel for home heating and industrial and utility boilers. Fuel oil is divided into two broad categories, distillate fuel oil, also known as No. 2 fuel, gasoil or diesel fuel; and residual fuel oil, also known as No. 6 fuel, or outside the United States, just as fuel oil. No. 2 fuel is a light oil used for home heating, in compression ignition engines and in light industrial applications. No. 6 oil is a heavy fuel used in large commercial, industrial and electric utility boilers.

Fundamental Analysis – The study of pertinent supply and demand factors which influence the specific price behavior of commodities. See also Technical Analysis.

Fungible – Interchangeable. Products which can be substituted for purposes of shipment or storage.

Futures Contract – A supply contract between a buyer and seller, whereby the buyer is obligated to take delivery and the seller is obligated to provide delivery of a fixed amount of a commodity at a predetermined price at a specified location. Futures contracts are traded exclusively on regu-

(NYMEX, December 1992, pp. 14-15)

lated exchanges and are settled daily based on their current value in the marketplace.

Futures Commission Merchant – An FCM is the only industry participant who receives, handles and manages customers' funds, margin payments and commission charges. He is also responsible for confirmation of trade slips, customer statements, and guarantees.

Futures-equivalent – A term frequently used with reference to speculative position limits for options on futures contracts. The futures-equivalent of an option position is the number of options multiplied by the previous day's risk factor or delta for the option series. For example, 10 deep out-of-the money options with a risk factor of 0.20 would be considered 2 futures-equivalent contracts. The delta or risk factors used for this purpose is the same as that used in delta-based margining and risk analysis systems.

Gamma – The sensitivity of an option's delta to changes in the price of the underlying futures contract.

Gasoil – European designation for No. 2 heating oil and diesel fuel.

Gasoline, straight-run – Also known as raw gasoline. Gasoline which is obtained directly from crude oil by fractional distillation. Straight-run gasoline generally must be upgraded to meet current motor fuel specifications.

Good till Canceled – An order to be held by a broker until it can be filled or until canceled.

Hallmark – A stamped impression on the surface of a precious metal bar that indicates the producer, serial number, weight and purity of metal content.

Heating Oil – No. 2 fuel oil, a distillate fuel oil used either for domestic heating or in moderate capacity commercial-industrial burners.

Heavy Crude – Crude oil with a high specific gravity and a low API gravity due to the presence of a high proportion of heavy hydrocarbon fractions.

Hedge – The initiation of a position in a futures or options market that is intended as a temporary substitute for the sale or purchase of the actual

commodity. The sale of futures contracts in anticipation of future sales of cash commodities as a protection against possible price declines, or the purchase of futures contracts in anticipation of future purchases of cash commodities as a protection against the possibility of increasing costs.

Hedger – A trader who enters the market with the specific intent of protecting an existing or anticipated physical market exposure from unexpected or adverse price fluctuations.

Hedge Ratio – 1) Ratio of the value of futures contracts purchased or sold to the value of the cash commodity being hedged, a computation necessary to minimize basis risk. 2) The ratio, determined by an option's delta, of futures to options required to establish a riskless position. For example, if a \$1/barrel change in the underlying futures price leads to a \$0.25/barrel change in the option premium, the hedge ratio is 4 (four options for each futures contract).

Historical Volatility – The annualized standard deviation of percent changes in futures prices over a specific period. It is an indication of past volatility in the marketplace.

Horizontal Spread – Calendar or time spread.

Hydrocarbons – Organic chemical compounds containing hydrogen and carbon atoms. They form the basis of all petroleum products.

Immediate or Cancel – An order which must be filled immediately or be canceled. IOC orders need not be filled in their entirety.

Implied Volatility – A measurement of the market's expected price range of the underlying commodity futures based on the market-traded option premiums.

In-the-Money – An option that can be exercised and immediately closed out against the underlying market for a cash credit. The option is in-the-money if the underlying futures price is above a call option's strike price, or below a put option's strike price.

Independent – Term generally applies to a non-integrated oil or natural gas company, usually active in only one or two sectors of the industry. An independent marketer buys petroleum prod-

(NYMEX, December 1992, pp. 16-17)

ucts from major or independent refiners and resells them under his own brand name or buys natural gas from producers and resells it. There are also independents which are active exclusively either in oil or gas production or refining.

Integration – A term that describes the degree in and to which one given company participates in all phases of the petroleum industry.

Interruptible Service – Utility service which expects and permits interruption on short notice, generally in peak-load periods, in order to meet the demand by firm service customers. Interruptible service customers usually pay a lower rate than firm service customers. Opposite of Firm Service.

Intrinsic Value – The amount by which an option is in-the-money. An option which is not in the money has no intrinsic value. For calls, intrinsic value equals the difference between the underlying futures price and the option's strike price. For puts, intrinsic value equals the option's strike price minus the underlying futures price. Intrinsic value is never less than zero.

Introducing Broker – A firm engaged in soliciting or in accepting orders for the purchase or sale of any commodity for future delivery.

Inverted Market – A futures market is said to be inverted when distant contract months are selling at a discount to nearby contract months; also known as backwardation.

Invisible Supply – Uncounted stocks of a commodity in the hands of wholesalers, manufacturers and producers which cannot be identified accurately; stocks outside commercial channels but theoretically available to the market.

In-well Transfer – An inventory transfer of propane held in underground caverns or storage.

Jet Fuel – Kerosene-type, high-quality kerosene product used primarily as fuel for commercial turbojet and turboprop aircraft engines.

Jobber – A middleman. A gasoline jobber, for example, might buy from refiners and would resell to small distributors or consumers.

Landed Price – The actual delivered cost of oil to a refiner, taking into account all costs from production or purchase to the refinery.

Last Trading Day – The final trading day for a particular delivery month futures contract or option contract. Any futures contracts left open following this session must be settled by delivery.

Lifting – Refers to tankers and barges loading cargoes of petroleum at a terminal or transshipment point.

Light Crude – Crude oil with a low specific gravity and high API gravity due to the presence of a high proportion of light hydrocarbon fractions.

Light Ends – The more volatile products of petroleum refining, such as butane, propane, ethane.

Limit – The maximum daily allowable amount a futures price may advance or decline in any one day's trading session.

Limit Order – A contingent order for an option or futures trade specifying a certain maximum (or minimum) price, beyond which the order (buy or sell) is not to be executed.

Liquefied Natural Gas (LNG) – Natural gas which has been made liquid by reducing its temperature to minus 258° Fahrenheit at atmospheric pressure. Its volume is 1/600 of gas in vapor form.

Liquefied Petroleum Gas (LPG) – Propane, butane, or propane-butane mixtures derived from crude oil refining or natural gas fractionation. For convenience of transportation, these gases are liquefied through pressurization.

Liquidation – The closing out of futures and options positions.

Liquidity – A market is said to be "liquid" when it has a high level of trading activity and open interest.

Local Distribution Company (LDC) – Company that distributes natural gas primarily to end-users. A gas utility.

Locked Market – A market where prices have reached their daily trading limit and trading can only be conducted at that price or prices which are closer to the previous settlement price.

(NYMEX, December 1992, pp. 18-19)

Long – 1) The market position of a futures contract buyer whose purchase obligates him to accept delivery unless he liquidates his contract with an offsetting sale. 2) One who has bought a futures contract to establish a market position. 3) In the options market, position of the buyer of a call or put option contract. Opposite of Short.

Long Hedge – Purchase of futures against the future market price purchase or fixed price forward sale of a cash commodity to protect against price increases.

Long the Basis – A person or firm that has bought the spot commodity and hedged with a sale of futures is said to be long the basis.

Lot – Any definite quantity of a futures commodity of uniform grade; the standard unit of trading.

Major – A term broadly applied to those multinational oil companies which by virtue of size, age, or degree of integration, are among the pre-eminent companies in the international petroleum industry.

Margin – The amount of money or collateral deposited by a customer with his broker, or deposited by a broker with a Clearing Member, or by a Clearing Member with the Clearinghouse, for the purpose of insuring the broker or Clearinghouse against adverse price movement on open futures contracts. The margin is not partial payment on a purchase. 1) Initial Margin is the minimum deposit per contract required by the broker when a futures position is opened. 2) Maintenance Margin is a sum which must be maintained on deposit at all times. If the equity in a customers' account drops to, or under, that level because of an adverse price movement, the broker must issue a margin call to restore the customers' equity. Margins are set by the Exchange based on its analysis of price risk volatility in the market at that time. See Variation Margin.

Margin Call – A demand for additional margin funds when futures prices move adverse to a trader's position, or if margin requirements are increased. Buyers of options are not subject to margin calls.

Market Correction – In technical analysis, a small reversal in prices following a significant trending period.

Market Maker – An independent trader or trading firm which is prepared to buy and sell futures or options contracts in a designated market. Market makers provide a two-sided (bid and ask) market and greater liquidity.

Market Order – An order to be filled immediately at the current market price.

Maximum Price Fluctuation – A commodity exchange's standardized maximum limits for fluctuations in futures prices during any one trading session.

Mcf – Thousand cubic feet.

Middle Distillate – Hydrocarbons that are in the so-called "middle boiling range" of refinery distillation. Examples are heating oil, diesel fuels, and kerosene.

Minimum Price Fluctuation – Minimum unit by which a futures price or an option premium can fluctuate per trade.

MMBtu – One million British thermal units, one dekatherm. Approximately equal to a thousand cubic feet (Mcf) of natural gas.

Mogas – Industry slang for motor gasoline.

Motor Gasoline – A complex mixture of relatively volatile hydrocarbons, with or without small quantities of additives, that have been blended to form a fuel suitable for use in spark-ignition engines.

Motor Oil – Refined lubricating oil, usually containing additives, used in internal combustion engines.

Naked – A long (short) market position taken without having an offsetting short (long) position. A trader who executes one side of a spread is said to be naked until he executes the other side.

Naphtha – A volatile, colorless product of petroleum distillation. Used primarily as a paint solvent, cleaning fluid, and blendstock in gasoline production.

Naphthenes – One of the three basic hydrocarbon classifications found naturally in crude oil. Naphthenes are widely used as petrochemical feedstocks.

National Futures Association – Trade association which promulgates rules of conduct and mediates disputes between customers and brokers.

(NYMEX, December 1992, pp. 20-21)

Natural Gas – A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous rock formations. Its principal component is methane.

Natural Gas Liquids (NGL) – A general term for all liquid products separated from natural gas in a gas processing plant. NGLs include propane, butane, ethane, and natural gasoline.

Netback – Industry term referring to the net FOB cost of product offered on a delivered or CIF basis. It is derived by subtracting all costs of shipment from the landed price.

Net Position – The difference between an individual or firm's open long contracts and open short contracts in any one commodity.

Neutral Spread – Another name for a delta neutral spread. Spreads may also be lot neutral, where the total number of long contracts and the total number of short contracts of the same type are approximately equal.

Nominal Price – The declared price for a futures month sometimes used in place of a closing price when no recent trading has taken place in that particular delivery month; usually an average of the bid and asked prices.

Non-associated Gas – Natural gas in a reservoir which contains no crude oil.

NYMEX ACCESS℠ – NYMEX ACCESS℠ is an interactive data communications network for bidding, offering and trading certain commodity futures and options contracts offered by the New York Mercantile Exchange for overnight trading. NYMEX provides the user with the equipment, software and services. ACCESS stands for American Computerized Commodity Exchange System and Services.

Octane Number – A measure of the resistance of gasoline to pre-ignite or knock when burned in an internal combustion engine.

Offer – A motion to sell a futures or option contract at a specified price. Opposite of Bid.

Offset – A transaction which liquidates or closes out an open contract position. In spread positions, one side offsets the other without liquidating the entire position. Risk is reduced when one side offsets the other.

Omnibus Account – An account carried by one futures commission merchant with another in which the transactions of two or more persons are combined rather than designated separately and the identity of the individual accounts is not disclosed.

One Cancels the Other – Two orders submitted simultaneously, either of which may be filled. If one order is filled, the other is considered to be canceled.

Open Interest or Commitment – The number of open or outstanding contracts for which an individual or entity is obligated to the Exchange because that individual or entity has not yet made an offsetting sale or purchase, an actual contract delivery, or, in the case of options, exercised the option.

Open Order – A resting order that is good until canceled.

Open Outcry – A method of public auction for making verbal bids and offers for contracts in the trading pits or rings of commodity exchanges.

Opening Price – The price for a given futures commodity that is generated by trading through open outcry during the opening stage of trading on a commodity exchange.

Option – A contract which gives the holder the right, but not the obligation, to purchase or to sell the underlying futures contract at a specified price within a specified period of time in exchange for a one-time premium payment. The contract also obligates the writer, who receives the premium, to meet these obligations.

Original Margin – The initial deposit of funds, as good faith monies, at the outset of trading a futures contract in order to guarantee fulfillment of its obligations. Also known as Initial Margin.

Out-of-the-Money – An option which has no intrinsic value. For calls, an option whose exercise price is above the market price of the underlying future. For puts, an option whose exercise price is below the futures price.

Overbought – A technical opinion that the market price has risen too steeply and too fast in relation to underlying fundamental factors.

(NYMEX, December 1992, pp. 22-23)

Oversold — A technical opinion that the market price has declined too steeply and too fast in relation to underlying fundamental factors.

Overwrite — The writing of more options than one expects to have exercised. Call options are overwritten because the writer considers the underlying overvalued. Put options are overwritten because the underlying is considered undervalued.

PAD (or PADD) — Petroleum Administration for Defense District. The United States is divided into five distinct marketing regions in which prices might differ due to variations in the supply or demand.

Paper Barrels — A term used to denote trade in non-physical oil (futures, forwards, swaps, etc.) markets which give a buyer or seller the right to a certain quantity and quality of crude oil or refined products at a future date, but not to any specific physical lot.

Par or Basis Grade — The grade or grades specified in a given futures contract for delivery. A contract may permit substitutions for and deviations from the par grade subject to specified premiums or discounts.

Petrochemical — An intermediate chemical derived from petroleum, hydrocarbon liquids, or natural gas, such as ethylene, propylene, benzene, toluene, and xylene.

Petroleum — A generic name for hydrocarbons, including crude oil, natural gas liquids, refined, and product derivatives.

Pin Risk — The risk to a trader who has sold an option that, at expiration, has a strike price identical to, or pinned to, the underlying futures price. In this case, the trader will not know whether he will be required to assume his options obligations.

Pipeline — A pipe through which oil or natural gas is pumped between two points, either offshore or onshore.

Pit or Ring — The place on the floor of an exchange where a commodity futures or options contract is traded by open outcry.

Point or Tick — The smallest monetary unit of change in a futures price or an option premium.

Position — The net total of a trader's open contracts, either long or short, in a particular underlying commodity.

Position Limit — For a single trader or firm, the maximum number of allowable open contracts with the same underlying commodity.

Posted Price — The price some refiners will pay for crude of a certain API gravity from a particular field or area.

Pour Point — A temperature 5° Fahrenheit higher than the temperature at which crude oil or a refined product stops flowing.

Premium — 1) The price or cost of an option determined competitively by buyers and sellers in open outcry trading on the exchange trading floor.
2) An upward adjustment in price allowed for delivery of a commodity of higher grade against a futures contract.

Price Discovery — The manner of making prices visible and readily available to the public.

Primary Stocks — Stocks of crude oil or refined products held in storage at leases, refineries, natural gas processing plants, pipelines, tankfarms, and bulk terminals that can store at least 50,000 barrels of refined products.

Processing Plant — Plant which separates natural gas into methane and the various other gases (e.g., propane, butane, ethane).

Prompt Barrel — Product which will move or become available within three to four days.

Propane — A natural hydrocarbon occurring in a gaseous state under normal atmospheric pressure and temperature, however, propane is usually liquefied through pressurization for transportation and storage. Propane is primarily used for rural heating and cooking and as a fuel gas in areas not serviced by natural gas mains and as a petrochemical feed stock.

Pump-Over — An intra, or inter-facility transfer. For example, when one pipeline pumps crude oil or refined products from its main or mainline into the mainline or storage tank of the receiving pipeline.

Put Option — An option which gives the buyer, or holder, the right, but not the obligation, to sell a

(NYMEX, December 1992, pp. 24-25)

futures contract at a specific price within a specific period of time in exchange for a one-time premium payment. It obligates the seller, or writer, of the option to buy the underlying futures contract at the designated price, should an option be exercised at that price. See Call Option.

Rack Price – Price charged by a supplier to a customer that buys transport truck lots at a terminal, on an FOB basis.

Rally – An advancing price movement following a decline in a market.

Range – The difference between the highest and lowest prices recorded during a given trading period.

Ratio Spread – Any spread where the number of long market contracts and the number of short market contracts are unequal.

Refiner-Marketer – A company that acts as a wholesaler of gasoline, heating oil or other products which operates its own refinery; may also retail and buy additional supplies to supplement its own refining output.

Refinery – A plant used to separate the various components present in crude oil and convert them into end-use products or feedstocks for other manufacturing processes.

Reforming Process – The use of heat and catalysts to effect the rearrangement of certain hydrocarbon molecules without altering their composition appreciably; for example, the conversion of low-octane naphthas or gasolines into high-octane number products.

Reportable Position – The number of futures contracts, as determined by the Exchange or the CFTC, above which a customer must be identified daily to the Exchange and to the CFTC with regard to the size of his position by commodity, by delivery month and by purpose of the trading.

Residual Fuel Oil – Heavy fuel oil produced from the residue in the fractional distillation process rather than from the distilled fractions.

Resistance – Opposite of Support.

Resting Order – An order away from the market, waiting to be executed.

Rollover – A special futures straddle trading procedure involving the shift of one month of a straddle into another future month while maintaining the other contract month of the original spread position. The shift can take place in either the long or short straddle month.

Round Lot – A quantity of a commodity equal in size to the corresponding futures contract for the commodity, as distinguished from a job lot, which may be larger or smaller than the contract.

Roundturn – The completion of both a purchase and sale of a commodity futures contract.

Scalper – A speculator on the trading floor of an exchange who buys and sells rapidly, with small profits or losses, holding his positions for only a short time during a trading session. Typically a scalper will stand ready to buy at a fraction below the last transaction price and to sell at a fraction above, thus creating market liquidity.

Seller's Market – A condition of the market in which there is a scarcity of goods available and hence sellers can obtain better conditions of sale or higher prices. See Buyer's Market.

Selling Hedge (or Short Hedge) – Selling futures contracts to protect against possible decreased prices of commodities. Also see Hedging.

Serial Expiration – Options on the same underlying futures contract which expire in more than one month. NYMEX platinum options have serial expiration.

Series – All options of the same class which share a common strike price.

Settlement or Settling Price – The price established by the Exchange Settlement Committee at the close of each trading session as the official price to be used by the Clearinghouse in determining net gains or losses, margin requirements, and the next day's price limits. The term "settlement price" is often used as an approximate equivalent to the term "closing price." The close in futures trading refers to a brief period at the end of the day, during which transactions frequently take place quickly and at a range of prices immediately before the bell. Therefore, those frequent-

(NYMEX, December 1992, pp. 26-27)

ly is no one closing price, but a range of prices. The settlement price is the closing price if there is only one closing price. When there is a closing range, it is derived by calculating the weighted average of prices during that period.

Short – 1) The market position of a futures contract seller whose sale obligates him to deliver the commodity unless he liquidates his contract by an offsetting purchase. 2) A trader whose net position in the futures market shows an excess of open sales over open purchases. 3) The holder of a short position. 4) In the options market, the position of the seller of a call or a put option. The short in the options market is obliged to take a futures position if he is assigned for exercise. Opposite of Long.

Short Selling – Selling a contract with the idea of delivering or of buying to offset it at a later date.

Short the Basis – The purchase of futures as a hedge against a commitment to sell in the cash or spot markets. See Hedging.

Sour or Sweet Crude – Industry terms which denote the relative degree of a given crude oil's sulfur content. Sour crude refers to those crudes with a comparatively high sulfur content, 0.5% by weight and above; sweet refers to those crudes with sulfur content of less than 0.5%.

Sour Gas – Natural gas found with a sufficiently high quantity of sulfur to require purifying prior to shipment or use.

Specifications – 1) Contract terms specified by the Exchange. 2) Term referring to the properties of a given crude oil or refined petroleum product, which are "specified" since they often vary widely even within the same grade of product. In the normal process of negotiation, seller will guarantee buyer that the product or crude to be sold will meet certain specified limits. Generally, the major properties of oil that are guaranteed are API gravity; sulfur; pour point; viscosity, and BS&W.

Specific Gravity – The ratio of the density of a substance at 60° F. to the density of water at the same temperature.

Speculative Position Limit – The maximum position, either net long or net short, in one commodity futures or option, or in all futures or options of one commodity combined which may be held or controlled by an entity without a hedge exemption as prescribed by an exchange or the CFTC.

Speculator – A trader who hopes to profit from the specific directional price move of a futures or option contract, or commodity.

Spot – Term which describes one-time open market cash transaction, where a commodity is purchased "on the spot" at current market rates. Spot transactions are in contrast to term sales, which specify a steady supply of product over a period of time.

Spot Month – The futures contract closest to maturity. The nearby delivery month.

Spread (Futures) – The simultaneous purchase of one futures contract and sale of a futures contract for a different month, different commodity or different grade of the same commodity.

Spread (Options) – The purchase and sale of two options which vary in terms of type (call or put), strike prices, expiration dates, or both. May also refer to an options contract purchase (sale) and the simultaneous sale (purchase) of a futures contract for the same underlying commodity.

Stock Type Settlement – A settlement procedure in which the purchase of a contract requires immediate and full payment by the buyer to the seller. In stock type settlement, the actual cash profit or loss from a trade is not realized until the position is liquidated. NYMEX energy and platinum options have this type of settlement procedure, which differs from that in the futures market where gains and losses are realized on a daily basis.

Stop Limit Order – An order that goes into force as soon as there is a trade at the specified stop price. The order however, can only be filled at the limit price or better. The stop price and the limit price can be the same or different. The stop price is the price level specified in the order.

Stop-Loss – A resting order designed to close out a losing position when the price reaches a level specified in the order. It becomes an at-the-market order when the "stop" price is reached. Individuals also use stops to enter the market when the prices reaches a specified level.

Straddle (Futures) – Also known as a spread, the purchase of one futures month against the sale of

(NYMEX, December 1992, pp. 28-29)

another futures month of the same commodity. A straddle trade is based on a price relationship between the two months.

Straddle (Options) – The purchase or sale of both a put and a call having the same strike price and expiration date. The buyer of a straddle benefits from increased volatility, and the seller benefits from decreased volatility.

Strangle – An option position consisting of the purchase or sale of put and call options having the same expiration but different strike prices.

Strike Price – The price at which the underlying futures contract is bought or sold in the event an option is exercised. Also called an exercise price.

Sulfur – An element that is present in some oil and gas as an impurity in the form of its various compounds.

Support – In technical analysis, a price area where new buying is likely to come in and stem any decline.

Synthetic Futures – A position created by combining call and put options. A synthetic long futures position is created by combining a long call options and a short put options for the same expiration date and the same strike price. A synthetic short futures is created by combining a long put and a short call with the same expiration date and the same strike price.

Swap – A custom-tailored, individually negotiated transaction designed to manage financial risk, usually over a period of one to 12 years. Swaps can be conducted directly by two counter-parties, or through a third party such as a bank or brokerage house. The writer of the swap, such as a bank or brokerage house, may elect to assume the risk itself, or manage its own market exposure on an exchange. Swap transactions include interest rate swaps, currency swaps and price swaps for commodities, including energy and metals. In a typical commodity or price swap, parties exchange payments based on changes in the price of a commodity or a market index, while fixing the price they effectively pay for the physical commodity. The transaction enables each party to manage exposure to commodity prices or index values. Settlements are usually made in cash.

Tank Train – A procedure in the rail shipment of crude oil, refined products, and other liquids developed by General American Transportation (GATX). "Tank Train" tank cars are interconnected, which permits loading and unloading of the entire train of cars from one connection.

Tariff – A schedule of rates or charges permitted a common carrier or utility; pipeline tariffs are the charges made by pipelines for transporting crude oil, refined products or natural gas from an origin to a destination.

Technical Analysis – An approach to forecasting commodity prices which examines patterns of price change, rates of change, and changes in trading volume and open interest, without regard to underlying fundamental market conditions.

Therm – 100,000 British thermal units. A dekatherm is 1 million Btus.

Theoretical Value – An option's value generated by a mathematical model given certain prior assumptions about the term of the option, the characteristics of the underlying futures contract, and prevailing interest rates.

Theta – The sensitivity of an option's theoretical value to a change in the amount of time to expiration.

Throughput – 1) A term used to describe the total volume of raw materials that are processed by a plant such as an oil refinery in a given period. 2) The total volume of crude oil and refined products that are handled by a tank farm, pipeline or terminal loading facility.

Tick – A minimum change in price, up or down.

Time Spread – The selling of a nearby option and buying of a more deferred option with the same strike price.

Time Value – Part of the option premium which reflects the excess over the intrinsic value, or the entire premium if there is no intrinsic value. At given price levels the option time value will decline until expiration. It is this decrease in time value that makes options a wasting asset.

Trade Limit Monitoring System – The system through which Clearing Members set and monitor limits on their customers' NYMEX ACCESS™

(NYMEX, December 1992, pp. 30-31)

accounts, including maximum order size, maximum position size per session, session trading volume and session trading losses.

Trader Workstation – A NYMEX ACCESS℠ workstation through which NYMEX ACCESS℠ orders are placed.

Trading – Buying and selling.

Trading Volume – The number of contracts that change hands during a specified period of time.

Transmission Company – Company that transports gas for resale on its own behalf or transports gas for others. Also known as a pipeline company.

Trend – The general direction of price movement.

Troy Ounce – The measurement of weight for precious metals:

1 ounce troy = 480 grains = 31.04 grams

1,000 grams = 1 kilogram = 32.15 ounces troy

1,000 kilograms = 1 metric ton = 32,150 ounces troy

Type of Option – Either puts or calls.

Underlying – The stock, commodity, futures contract or cash index against which the futures or options contract is valued.

Variation Margin – Payment made on a daily or intraday basis by a Clearing Member to the Clearinghouse to cover losses created by adverse price movement in positions carried by the Clearing Member, calculated separately for customer and proprietary positions.

Vega – The sensitivity of an option's theoretical value to a change in volatility.

Viscosity – A method of measuring a given liquid's resistance to flow, usually decreasing with increasing temperatures. Material with higher viscosity is more resistant to flow.

Volatility – The market's price range and movement within that range. The direction of the price move, whether up or down, is not relevant. Historic volatility indicates how much prices have changed in the past and is derived by using daily settlement prices for futures. Implied volatility measures how much the market thinks prices will change in the future, and is obtained from daily settlement prices for options.

West Texas Intermediate – A grade of crude oil deliverable against the New York Mercantile Exchange light sweet crude oil contract. Nominally, the benchmark crude of the U.S. oil industry.

Wet Barrel – A physical barrel of crude oil or refined product as opposed to a "paper barrel."

Wet Gas – Natural gas containing condensable hydrocarbons.

Writer – The seller of an option. Also known as the grantor of the option.

Yield – 1) A measure of the annual return on an investment expressed as a percentage. 2) The proportion of heavy or light products which can be derived from a given barrel of crude oil.

(NYMEX, December 1992, pp. 32-33)

APPENDIX G - FUTURES CONTRACT SPECIFICATIONS

Light Sweet Crude Oil

Futures and Options Contract Specifications

Trading Unit	*Futures:* 1,000 U.S. barrels (42,000 gallons). *Options:* One NYMEX light sweet crude oil contract.
Trading Hours	*Futures* and *Options:* 9:45 a.m. - 3:10 p.m. (New York Time).
Trading Months	*Futures:* 18 consecutive months plus four long-dated futures which are initially listed 21, 24, 30 and 36 months prior to delivery. *Options:* Six consecutive months plus two long-dated options which are initially listed nine and 12 months prior to expiration.
Price Quotation	*Futures and Options:* Dollars and cents per barrel.
Minimum Price Fluctuation	*Futures and Options:* $.01 (1¢) per barrel ($10 per contract).
Maximum Daily Price Fluctuation	*Futures:* $15.00 per barrel ($15,000 per contract) for the first two contract months. Initial back month limits of $1.50 per barrel rise to $3.00 per barrel if the previous day's settlement price is at the $1.50 limit. In the event of a $7.50 move in either of the first two contract months, back month limits are expanded to $7.50 per barrel from the limit in place in the direction of the move. *Options:* No price limits.
Last Trading Day	*Futures:* Trading terminates at the close of business on the third business day prior to the 25th calendar day of the month preceding the delivery month. *Options:* Expiration Day is the second Friday of the month prior to the delivery month of the underlying futures contract, provided there are at least five days remaining to trade in the underlying futures contract. *Note:* Effective July 13, 1992, Expiration Day for all newly listed options contracts is the Friday immediately preceding the expiration of the underlying futures contract as long as there are three trading days left in the futures contract. In the event there are less than three days to futures expiration, option expiration is the second Friday prior to futures expiration.
Exercise of Options	By a Clearing Member to the NYMEX Clearing House not later than 6:00 p.m., or 45 minutes after the underlying futures settlement price is posted, whichever is later, on any day up to and including the option's expiration.

(NYMEX, November 1992, p. 10)

Option Strike Prices

At all times at least 17 strike prices are available for puts and calls on the underlying futures contracts. The first 11 strike prices are increments of $1.00 per barrel; additionally, three strike prices are offered in the nearest $5 increments above the nearest higher and below the nearest lower existing strike prices. The at-the-money strike price is nearest to the previous day's close of the underlying futures contract. Strike price boundaries are adjusted according to the futures price movements.

Delivery

F.O.B. seller's facility, Cushing, Oklahoma, at any pipeline or storage facility with pipeline access to ARCO, Cushing Storage or Texaco Trading and Transportation Inc., by in-tank transfer, inline transfer, book-out or inter-facility transfer (pumpover).

Delivery Period

All deliveries are ratable over the course of the month and must be initiated on or after the first calendar day and completed by the last calendar day of the delivery month.

Alternate Delivery Procedure (ADP)

An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP)

The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Deliverable Grades

Specific crudes with 0.5% sulfur by weight or less, not less than 34° API gravity nor more than 45° API gravity. The following crude streams are deliverable: West Texas Intermediate, Mid-Continent Sweet, Low Sweet Mix, New Mexican Sweet, North Texas Sweet, Oklahoma Sweet, South Texas Sweet, Brent Blend, Bonny Light and Oseberg.

Inspection

Inspection shall be conducted in accordance with pipeline practices. A buyer or seller may appoint an inspector to inspect the quality of oil delivered. However, the buyer or seller who requests the inspection will bear its costs and will notify the other party of the transaction that the inspection will occur.

Customer Margin Requirements

Margins are required for open futures or short options positions. See page 34. There is no margin requirement for an options purchaser.

(NYMEX, November 1992, p. 11)

Sour Crude Oil

Futures Contract Specifications

Trading Unit	1,000 U.S. barrels (42,000 gallons).
Trading Hours	9:35 a.m.-3:20 p.m. (New York Time).
Trading Months	18 consecutive months.
Price Quotation	U.S. dollars and cents per barrel.
Minimum Price Fluctuation	$0.01 (1¢) per barrel ($10 per contract).
Maximum Daily Price Fluctuation	$15.00 per barrel ($15,000 per contract) for the first two contract months. Initial back month limits of $1.50 per barrel rise to $3.00 per barrel if the previous day's settlement price is at the $1.50 limit. In the event of a $7.50 move in either of the first two contract months, back month limits are expanded to $7.50 per barrel above the limit in place, in the direction of the move.
Last Trading Day	Trading terminates at the close of business on the third business day prior to the 25th calendar day of the month preceding the delivery month.
Delivery	Deliveries take place along the Texas U.S. Gulf Coast at one of several qualified marine terminals; by pipeline into designated pipeline connections; or out-of-storage from qualified storage facilities.
Marine Terminal Delivery	ARCO Pipe Line Co. (Texas City, Texas); Oiltanking Inc. (Houston, Texas); Sun Marine Terminals (Nederland, Texas).
Pipeline Delivery	Rancho Pipeline (Houston area including Pasadena Junction, Missouri City Junction and Genoa Junction); Texaco Trading and Transportation Inc. (East Houston, Texas).
Delivery Out-of-Storage	Amerada Hess Corp. (Houston, Texas); Oiltanking Inc. (Houston, Texas); Sun Marine Terminals (Nederland, Texas); Texaco Trading and Transportation Inc. (East Houston, Texas).
Delivery Period	All deliveries must be initiated by the first calendar day and completed no later than the last calendar day of the delivery month.
Alternate Delivery Procedure (ADP)	An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and

(NYMEX, November 1992, p. 12)

seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of intent to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP)

The buyer or seller may exchange a futures position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Deliverable Grades

Deliverable grades with a minimum of 0.5% and a maximum of 2.2% sulfur by weight, not less than 26° API gravity are:
West Texas Sour/New Mexico Sour, Alaska North Slope, Dubai, Flotta, Iranian Light, Oman and Oriente.

Commingling these crude streams for delivery is not permitted except for pipeline common stream designed as West Texas Sour/New Mexico Sour. A premium of 90¢ per barrel will be paid by the receiving party for the delivery of West Texas Sour/New Mexico Sour. The other six deliverable crudes will be valued at the final settlement price.

Inspection

For marine terminal delivery, the seller selects and hires an inspection company with international operations including in-house laboratory facilities in both Houston and Beaumont/Port Arthur. Inspection procedures must comply with API guidelines for quantity measurement (2% tolerance), gravity, bottom sediment and water, and sulfur.

Delivery out-of-storage of West Texas Sour/New Mexico Sour affords the buyer or seller the right to inspect quantity and/or quality at the requesting party's expense.

Delivery out-of-storage for foreign streams require sellers to provide an inspection report (no more than 30 days old) from an inspection company that meets marine terminal delivery requirements.

For pipeline deliveries, inspections are conducted in accordance with pipeline practices. Either buyer or seller may appoint an inspector to review the quality of the oil delivered. However, the buyer or seller who requests the inspection will bear its costs and notify the other party of the planned inspection.

Customer Margin Requirements

Margins are required for open futures positions. See page 34.

NYMEX, November 1992, p. 13)

Heating Oil

Futures and Options Contract Specifications

Trading Unit	*Futures:* 42,000 U.S. gallons (1,000 barrels). *Options:* One NYMEX heating oil futures contract.
Trading Hours	*Futures and Options:* 9:50 a.m. - 3:10 p.m. (New York Time).
Trading Months	*Futures:* Trading is conducted in 18 consecutive months commencing with the next calendar month (e.g., on October 1, 1992, trading occurs in all months from November 1992 through April 1994). *Options:* Six consecutive months plus two long-dated options which are initially listed nine and 12 months prior to expiration.
Price Quotation	*Futures and Options:* In dollars and cents per gallon (e.g., $0.5277 per gallon).
Minimum Price Fluctuation	*Futures and Options:* $0.0001 (0.01¢) per gallon ($4.20 per contract).
Maximum Daily Price Fluctuation	*Futures:* $0.40 per gallon ($16,800 per contract) for the first two contract months. Initial back month limits of $0.04 per gallon rise to $0.06 per gallon if the previous day's settlement price is at the $0.04 limit. In the event of a $0.20 move in either of the first two contract months, back month limits are expanded to $0.20 per gallon from the limit in place in the direction of the move. *Options:* No price limit.
Last Trading Day	*Futures:* Trading terminates at the close of business on the last business day of the month preceding the delivery month. *Options:* Expiration Day is the second Friday of the month prior to the delivery month of the underlying futures contract. *Note:* Effective July 13, 1992, Expiration Day for all newly listed options contracts is the Friday immediately preceding the expiration of the underlying futures contract as long as there are three trading days left in the futures contract. In the event there are less than three days to futures expiration, option expiration is the second Friday prior to futures expiration.
Exercise of Options	By a Clearing Member to the NYMEX Clearing House not later than 6:00 p.m., or 45 minutes after the price of the underlying futures settlement price is posted, whichever is later, on any day up to and including the option's expiration.

(NYMEX, November 1992, p. 16)

Option Strike Prices Strike prices are in increments of \$0.02 (2¢) per gallon. Strike prices are listed only as even numbers, for example \$0.4800, \$0.5000, \$0.5200, etc. At all times at least 11 strike prices are listed. The at-the-money strike price is closest to the previous day's close of the underlying futures contract. Strike price boundaries are adjusted according to the futures price movements.

Delivery F.O.B. seller's facility in New York Harbor, ex-shore. All duties, entitlements, taxes, fees and other charges paid. Seller's shore facility must be capable of delivering into barges. Delivery may also be completed by pipeline, tanker, book transfer or inter- or intra-facility transfer. Delivery must be made in accordance with applicable federal, state and local licensing and tax laws.

Delivery Period All deliveries may only be initiated after the fifth business day and must be completed before the last business day of the delivery month.

Alternate Delivery Procedure (ADP) An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP) The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Grade and Quality Specifications Generally conforms to industry standards for fungible No. 2 heating oil.

Inspection The buyer may request an inspection for grade and quality or quantity for all deliveries, but shall require a quantity inspection for a barge, tanker or inter-facility transfer. If the buyer does not request a quantity inspection, the seller may request such inspection. The cost of the quantity inspection is shared equally by the buyer and seller. If the product meets grade and quality specifications, the cost of the quality inspection is shared jointly by the buyer and seller. If the product fails inspection, the cost is borne by the seller.

Customer Margin Requirement Margins are required for open futures and short options positions. See page 34. There is no margin requirement for an options purchaser.

(NYMEX, November 1992, p. 17)

New York Harbor Unleaded Gasoline

Futures and Options Contract Specifications

Trading Unit
Futures: 42,000 U.S. gallons (1,000 barrels).
Options: One NYMEX New York Harbor Unleaded Gasoline Futures Contract.

Trading Hours
Futures and Options: 9:50 a.m. - 3:10 p.m. (New York Time).

Trading Months
Futures: Trading in New York Harbor unleaded gasoline is conducted in 18 consecutive months commencing with the next calendar month (e.g., on October 1, 1992, the first trading month is November 1992).

Note: In May 1991 the Exchange temporarily reduced to nine the number of months traded, citing uncertain oxygenation requirements for gasoline sold in the New York Harbor area. On June 1, 1992, trading was expanded to September 1993. which will remain the farthest dated month until further notice.

Options: Six consecutive months plus two long-dated options which are initially listed nine and 12 months prior to expiration.

Price Quotation
Futures and Options: In dollars and cents per gallon (e.g., \$0.5022 per gallon).

Minimum Price Fluctuation
Futures and Options: \$0.0001 (0.01¢) per gallon (\$4.20 per contract).

Maximum Daily Price Fluctuation
Futures: \$0.40 per gallon (\$16,800 per contract) for the first two contract months. Initial back month limits of \$0.04 per gallon rise to \$0.06 per gallon if the previous day's settlement price is at the \$0.04 limit. In the event of a \$0.20 move in either of the first two contract months, back month limits are expanded to \$0.20 per gallon from the limit in place in the direction of the move.
Options: No price limit.

Last Trading Day
Futures: Trading terminates at the close of business on the last business day of the month preceding the delivery month.
Options: Expiration Day is the second Friday of the month prior to the delivery month of the underlying futures contract.

Note: Effective July 13, 1992, Expiration Day for all newly listed options contracts is the Friday immediately preceding the expiration of the underlying futures contract as long as there are three trading days left in the futures contract. In the event there are less than three days to futures expiration, option expiration is the second Friday prior to futures expiration.

Exercise of Options
By a Clearing Member to the NYMEX Clearing House not later than 6:00 p.m., or 45 minutes after the underlying futures

(NYMEX, November 1992, p. 21)

settlement price is posted, whichever is later, on any day up to and including the option's expiration.

Option Strike Prices Strike prices are in increments of $0.02 (2 cents) per gallon. Strike prices are listed only as even numbers, for example $0.4800, $0.5000, $0.5200, etc. At all times at least 11 strike prices are listed. The at-the-money strike price is closest to the previous day's close of the underlying futures contract. Strike price boundaries are adjusted according to the futures price movements.

Delivery F.O.B. seller's facility in New York Harbor ex-shore. All duties, entitlements, taxes, fees and other charges paid. Seller's shore facility must be capable of delivering into barges. Delivery may also be completed by pipeline, tanker, book transfer or inter- or intra-facility transfer. Delivery must be made in accordance with applicable federal, state and local licensing and tax laws.

Delivery Period All deliveries may only be initiated after fifth business day and must be completed before the last business day of the delivery month.

Alternate Delivery Procedure (ADP) An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP) The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Grade and Quality Specifications Generally conforms to industry standards for fungible northern grade, unleaded regular gasoline specifications.

Inspection The buyer may request an inspection for grade and quality or quantity for all deliveries, but shall require a quantity inspection for a barge, tanker or inter-facility transfer. If the buyer does not request a quantity inspection, the seller may request such inspection. The cost of the quantity inspection is shared equally by the buyer and seller. If the product meets grade and quality specifications, the cost of the quality inspection is shared jointly by the buyer and seller. If the product fails inspection, the cost is borne by the seller.

Customer Margin Requirements Margins are required for open futures or short options positions. See page 34. There is no margin requirement for an options purchaser.

(NYMEX, November 1992, p. 22)

Gulf Coast Unleaded Gasoline

Futures Contract Specifications

Trading Unit 42,000 U.S. gallons (1,000 barrels).

Trading Hours 9:40 a.m. to 3:10 p.m. (New York Time).

Trading Months Trading will be conducted in 18 consecutive months (e.g., on September 17, 1992, trading occurs in all months from October 1992 through March 1994).

Price Quotation In dollars and cents per gallon (e.g. $0.6255 per gallon).

Minimum Price Fluctuation $0.0001 (0.01¢) per gallon ($4.20 per contract).

Maximum Daily Price Fluctuation $0.40 per gallon ($16,800 per contract) for the first two months, to be implemented in two steps. Initial back month limits of $0.04 per gallon rise to $0.06 if the previous settlement price is at $0.04. In the event of a $0.20 move in either of the first two contract months, back month limits expand to $0.20 per gallon from the limit in place in the direction of the move.

Last Trading Day Trading terminates at the close of business on the last business day of the month preceding the delivery month.

Delivery Sizes All matches of buyers and sellers for deliveries of contracts in multiples of 25 (25,000 barrels) shall be required to be made into the Colonial Pipeline, basis Pasadena, Texas. All tenders for deliveries of less than 25 contracts shall be required to be made at a public terminal in the Houston/Pasadena area.

Pipeline Deliveries For all deliveries of 25 or more contracts (25,000 barrels) delivery will be made F.O.B. the Colonial Pipeline at the injection station selected by the seller at Pasadena, Houston, Hebert or Port Arthur, Texas; Lake Charles, Krotz Springs or Baton Rouge, Louisiana; Collins, Mississippi or Moundville, Alabama.

Public Terminal Deliveries Deliveries of less than 25 contracts shall be made at public facilities maintained by GATX Terminals Corp., Oiltanking Houston Inc., or Amerada Hess Corp. in the Houston and Pasadena, Texas, area ("Qualified Facility"), F.O.B. into the buyer's segregated or fungible storage. At the seller's option, delivery at such facility may be accomplished by any of the following methods:

(1) Intra-facility transfer by pump-over or inventory transfer;

(2) Inter-facility transfer by pump-over or inventory transfer; or

(NYMEX, November 1992, p. 23)

Delivery Surcharge

If delivery is made at a public terminal, the buyer or seller whose Notice(s) of Intention to Accept or Deliver in a quantity not evenly divisible by 25 will be assessed a surcharge payable to the other party of $0.0175 (1.75¢) per gallon for every contract that is not evenly divisible by 25, except that if both parties' Notices are not evenly divisible by 25, no surcharge will be assessed.

Delivery Period

For pipeline deliveries, the buyer may accept product as early as the first day of the second Colonial cycle that commences during the delivery month, but no earlier than the ninth calendar day of the delivery month, and no later than the day prior to the last business day of the delivery month. Exceptions occur if a third Colonial cycle commences during the delivery month which extends beyond the day prior to the last business day of the delivery month, delivery may extend through the last day of that cycle.

For public terminal deliveries, the buyer may accept product as early as the ninth calendar day of the delivery month, and no later than the day prior to the last business day of the delivery month, provided, however, that in the event the buyer nominates the front half of the second cycle of the delivery month, the four-day delivery window may commence as early as two days prior to the start of the second Colonial cycle of the delivery month.

Alternate Delivery Procedure (ADP)

An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP)

The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Deliverable Grades

Grade and Quality *Specifications* reflect those of Colonial Pipeline Co. fungible Southern Grade 44, 87-octane unleaded regular gasoline as amended from time-to-time by Colonial

(NYMEX, November 1992, p. 24)

Pipeline, with the following exceptions: Reid Vapor Pressure for this contract shall be January and February, 13.5 pounds per square inch; March, April, May, June, July and August, 7.5 psi; September and October, 11.5 psi, November and December, 13.5 psi. In the event that this RVP specification differs from the Colonial Pipeline specification at the time of loading, an RVP adjustment of 0.5¢ per psi per gallon for RVP of 8.7 psi and above, or 0.75¢ per psi per gallon for RVP below 8.7 psi, will apply.

Inspection

For pipeline deliveries, inspection of product shall be made in accordance with Colonial Pipeline practices.

For public terminal deliveries by pump-over or inventory transfer, if inspection is requested by the buyer, the seller shall initiate inspection of the product at its designated originating facility not later than 24 hours prior to the nominated time of delivery.

For barge movements, seller shall initiate inspection on dedicated barge at the originating facility not later than 24 hours prior to the time designated by the seller for delivery.

Customer Margin Requirements

Margins are required for open futures positions. See page 34.

(NYMEX, November 1992, p. 25)

Natural Gas

Futures and Options Contract Specifications

Trading Unit	*Futures:* 10,000 million British thermal units (MMBtu). *Options:* One NYMEX natural gas futures contract.
Trading Hours	9:20 a.m. - 3:10 p.m. (New York Time).
Trading Months	*Futures:* Trading is conducted in 18 consecutive months commencing with the next calendar month (e.g., on October 1, 1992, trading occurs in all months from November 1992 through April 1994). *Options:* 12 consecutive months.
Price Quotation	*Futures and Options:* Dollars and cents per MMBtu (e.g., $2.000 per MMBtu).
Minimum Price Fluctuation	*Futures and Options:* $0.001 (0.1¢) per MMBtu ($10 per contract).
Maximum Daily Price Fluctuation	*Futures:* $0.10 (10¢) per MMBtu ($1,000 per contract). There is no maximum daily limit on price fluctuations during the month preceding the delivery month. In the event that a settlement price is established at the maximum daily limit on price fluctuations, this limit will be increased subject to a variable limits formula. *Options:* No price limit.
Last Trading Day	*Futures:* Trading terminates six business days prior to the first calendar day of the delivery month. *Options:* Trading terminates at the close of business on the Friday immediately preceding the expiration of the underlying futures contract as long as there are at least three days remaining to trade in the underlying futures contract. In the event there are less than three trading days to futures expiration, option expiration is the second Friday prior to futures expiration.
Exercise of Options	By a Clearing Member to the NYMEX Clearing House not later than 6 p.m. or 45 minutes after the underlying futures settlement price is posted, whichever is later, on any day up to and including the option's expiration.
Option Strike Prices	Strike prices are in increments of $0.05 (5¢) per MMBtu. At all times at least 11 strike prices are available for calls and puts on the underlying futures contracts. The at-the-money strike price is closest to the previous day's close of the underlying futures contract. Strike price boundaries are adjusted according to the futures price movements.

(NYMEX, November 1992, p. 28).

Delivery Sabine Pipe Line Co.'s Henry Hub in Louisiana. Seller is responsible for the movement of the gas through the Hub; the buyer, from the Hub. The Hub fee will be paid by seller.

Delivery Period Delivery shall take place no earlier than the first calendar day of the delivery month and shall be completed no later than the last calendar day of the delivery month. All deliveries shall be made at as uniform as possible an hourly and daily rate of flow over the course of the delivery month.

Alternate Delivery Procedure (ADP) An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.

Exchange of Futures for, or in Connection with, Physicals (EFP) The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.

Quality Specifications Pipeline specifications in effect at time of delivery.

Customer Margin Requirements Margins are required for open futures and short options positions. See page 34. There is no margin requirement for an options purchaser.

(NYMEX, November 1992, p. 29)

Propane

Futures Contract Specifications

Trading Unit	42,000 U.S. gallons (1,000 barrels).
Trading Hours	9:15 a.m. - 3:00 p.m. (New York Time).
Trading Months	Trading is conducted in 15 consecutive months commencing with the next calendar month (e.g., on October 1, 1992, trading occurs in all months from November 1992 through January 1994).
Price Quotation	In dollars and cents per gallon (e.g., $0.2555 per gallon).
Minimum Price Fluctuation	$0.0001 (0.01¢) per gallon ($4.20) per contract).
Maximum Daily Price Fluctuation	$0.40 per gallon ($16,800 per contract) for the first two contract months. Initial back month limits of $0.04 per gallon rise $0.06 per gallon if the previous day's settlement price is at the $0.04 limit. In the event of a $0.20 move in either of the first two contract months, back month limits expand to $0.20 per gallon from the limit in place in the direction of the move.
Last Trading Day	Trading terminates at the close of business on the last business day of the month preceding the delivery month.
Delivery	F.O.B. seller's pipeline, storage, or fractionation facility in Mont Belvieu, Texas, with direct pipeline access to the Texas Eastern Transmission Pipeline in Mont Belvieu, Texas. Delivery may be made by in-line or in-well transfer, inter-facility transfer or pump-over, or book transfer.
Delivery Period	All deliveries must be initiated after the ninth business day and completed before the second to last business day of the delivery month.
Alternate Delivery Procedure (ADP)	An Alternate Delivery Procedure is available to buyers and sellers who have been matched by the Exchange subsequent to the termination of trading in the spot month contract. If buyer and seller agree to consummate delivery under terms

(NYMEX, November 1992, p. 32)

	different from those prescribed in the contract specifications, they may proceed on that basis after submitting a notice of their intention to the Exchange.
Exchange of Futures for, or in Connection with, Physicals (EFP)	The buyer or seller may exchange a futures position for a physical position of equal quantity by submitting a notice to the Exchange. EFPs may be used to either initiate or liquidate a futures position.
Grade and Quality Specifications	Conforms to industry standards for fungible liquified propane gas as determined by the Gas Processors Association (GPA-HD5).
Inspection	Inspection shall be conducted in accordance with pipeline practices.
Customer Margin Requirements	Margins are required for open futures positions. See page 34.

(NYMEX, November 1992, p. 33)

Margin Requirements

NYMEX requires its market participants to post and maintain in their accounts a certain minimum amount of funds for each open position held. These funds are known as "margin" and represent a good faith deposit or performance bond that serves to provide protection against losses in the market. NYMEX collects margin directly from each of its Clearing Members who, in turn, are responsible for the collection of funds from their clients.

NYMEX uses Standard Portfolio Analysis of Risk (SPAN) to establish minimum margin levels for Clearing Firms and their customers. SPAN, developed by the Chicago Mercantile Exchange, has become the futures industry's standard of margining. SPAN evaluates the risk of a trader's entire portfolio and establishes plausible movements in futures prices over a one-day period. The resulting effect of these "risk arrays" is to capture respective gains or losses on futures and options positions across the energy commodities.

One of the special characteristics of options is that a long option position can never be at risk for more than its premium. For SPAN to assess the risk of all positions in the portfolio and at the same time allow credit for the premium involved, SPAN allows the excess of the option premium over the risk margin for any option position to be applied to the risk margin on other positions.

Margin requirements and contract specifications are subject to change. Please contact the New York Mercantile Exchange, Fastfacts, the NYMEX 24-hour market information service, or your broker for current information.

(NYMEX, November 1992, p. 34)

Miscellaneous Information

Trading in Oil Spreads

Any combination of energy futures contracts and/or months may constitute a spread in the NYMEX energy complex. All spreads are traded by open outcry.

The following are brief definitions of the most commonly traded spreads:

Intra-market Spreads
The simultaneous purchase and sale of a futures contract in any one commodity, crude oil, heating oil, gasoline, propane or natural gas, in two different months at a stated price differential.

Inter-market Spreads
Also known as "trading across the barrel." Inter-market spreads consist of the simultaneous purchase and sale of more than one economically-related futures contracts — crude oil, heating oil, gasoline, propane or natural gas — in one or more months at a stated price differential.

Crack Spreads
Simultaneous purchase and sale of the crude oil contract and contracts for refined products — either gasoline or heating oil or both — in one or more months at a stated price differential. The number of crude contracts and the combined total of product contracts must be equal. A similar strategy involving natural gas and propane is called a frac spread.

Speculative Position Limits
The Exchange sets limits on speculative positions (net long or short by contract) which may be exceeded for bona fide hedge transactions or risk associated with commodity swap transactions. Authorization from the President of the Exchange is required.

(NYMEX, November 1992, p. 35)

Quote Services

Vendor	Commodity					
	Sweet Crude	Sour Crude	Heating Oil	Gasoline	Natural Gas	Propan
CBC	CL	SC	HO	HU	NG	PN
ADP						
ADP Comtrend	OL	CZ	HO	HU	NA	NP
ADP FIS	C1CL	C1SC	C1HO	C1HU	C1NG	C1PN
Bloomberg L.P.	CL	SC	HO	HU	NG	PN
Bonneville Market Info	CL	SC	HO	NU	NG	PN
Bridge Market Data Systems	CL (1&2 yr) CP (3&4 yr)	DI	HO	QL	NO	PT
Commodity Quotegraphics	CL	SC	HO	UR	RF	LG
Dow Jones	CL	SC	HO	HU	NG	PN
EMIS/ McGraw Hill	CL	SC	HO	HU	NG	PN
FNN Data Broadcasting	CL	SC	HO	HU	NG	PN
Futuresource	CL	SC	HO	HU	NG	PN
Knight-Ridder						
CNS Dataquote	CL	SO	HO	HU	NG	PN
MoneyCenter	CL	SO	HO	HU	NG	PN
TradeCenter	CL	SO	HO	HU	NG	PN
Market Vision	CL	78	HO	HU	QO	PT

(NYMEX, November 1992, p. 36)

	Sweet Crude	Sour Crude	Heating Oil	Gasoline	Natural Gas	Propane
PC Quote	CL	SC	HO	HU	NG	PN
Platt's Global Alert	CL	SC	HO	HU	NG	PN
Quotron Systems	CL CA (3,4,5 yrs)	SC	HO	HU	NG	PN
Reuters Info Services						
SDS2	CL/CL2	SC/SC2	HO/HO2	HU/HU2	NG/NG2	PN-PN2
Monitor	LC65/ LC66	SC65/ LC66	HO65/ HO66	UG65/ UG66	NG65/ NG66	PR65/ PR66
IDN(R2000)	CL:CHAIN	SC:CHAIN	HO:CHAIN	HU:CHAIN	NG:CHAIN	PN:CHAIN
Shark	CL	SC	HO	HU	NG	PN
S&P Comstock	CL	SC	HO	HU	NG	PN
Telekurs Inc.	CL	SC	HO	HU	NG	PN
Telerate Systems Retrieval is by entering page number	8810	8808- 8809-	8806- 8811	8807	8813 9249	8812

Note: Appropriate month codes must be appended to these vendor symbols prior to any retrieval requests.

(NYMEX, November 1992, p. 37)

SELECTED DATA

APPENDIX H - SELECTED DATA

Month	JP5	WTI Buy	WTI Sell	Hdg Swgs	Strike	Put Buy	Put Sell	Put Swgs	Tot Swgs
O86	16.49	15.10	14.88	-0.28				0	-0.28
N	17.04	16.88	16.84	-0.01				0	-0.01
D	14.88	15.28	15.15	-0.15				0	-0.15
J87	17.38	16.21	16.01	3.8				0	3.8
F	16.84	16.10	16.45	3.30				0	3.30
M	16.05	16.10	16.12	2.88				0	2.88
A	20.82	16.70	16.11	-0.07				0	-0.07
M	20.75	16.48	16.41	0.88				0	0.88
J	20.71	16.27	16.82	1.35				0	1.35
J	20.38	16.14	21.38	3.10				0	3.10
A	21.97	16.05	20.73	2.88				0	2.88
S	22.88	16.01	19.97	1.88				0	1.88
O	24.88	16.82	18.88	0.08				0	0.08
N	24.01	16.88	18.84	-0.88				0	-0.88
D	22.85	16.44	18.51	-0.88				0	-0.88
J88	23.10	16.38	16.75	-2.88				0	-2.88
F	21.28	16.28	17.13	-2.10				0	-2.10
M	19.88	16.38	16	-3.28				0	-3.28
A	21.81	17.01	17.89	0.88				0	0.88
M	21.84	16.9	17.48	0.88				0	0.88
J	22.10	16.88	16.73	-0.1				0	-0.1
J	20.07	16.76	14.78	-1.88				0	-1.88
A	20.98	16.7	15.71	-0.89				0	-0.89
S	16.88	16.88	14.48	-2.16				0	-2.16
O	16.02	13.08	13.8	0.84				0	0.84
N	16.08	12.74	12.88	1.24				0	1.24
D	22.80	12.88	16.08	3.4				0	3.4
J89	21.84	12.88	17.88	5.08				0	5.08
F	24.38	12.88	17.73	5.04				0	5.04
M	22.88	12.73	18.5	5.77				0	5.77
A	26.08	16.05	20.89	0.84				0	0.84
M	27.28	16.84	19.02	0.88				0	0.88
J	28.44	16.72	19.38	0.84				0	0.84
J	26.07	16.38	20.38	2.07				0	2.07
A	21.89	17.08	16.89	0.08				0	0.08
S	22.08	17.82	16.78	2.14				0	2.14
O	24.10	20.01	20.17	0.16	20	0.25	0	-0.25	-0.09
N	25.27	19.77	19.84	0.07				0	0.07
D	30.02	19.88	20.7	1.12				0	1.12
J90	28.45	19.42	22.9	3.48				0	3.48
F	28.00	19.27	22.08	2.78				0	2.78
M	27.02	19.15	20.24	1.09				0	1.09
A	28.38	20.48	17.88	-2.8	20	0.07	0.85	0.78	-2.02
M	24.24	20.8	19.02	-1.78	20	0.26	1	0.74	-1.04
J	22.89	20.88	16.82	-4.16	20	0.22	3.23	2.91	-1.25
J	27.85	21.08	16.94	-4.09	21	0.48	4.07	3.64	-0.45
A	26.01	21.05	26.25	5.16	21	0.82	0.01	-0.81	4.37
S	34.42	21.04	31.3	10.28	21	0.89	0.01	-0.88	9.88
O	41.84	37.08	38.89	1.8	37	2	0.35	-1.65	-0.05
N	40.38	37.31	31.87	-5.44	37	4.17	3.11	-1.06	-6.5
D	40.88	35.78	29.9	-5.88	35	4.3	8.42	4.12	-4.73
J91	30.38	34.4	27.71	-6.89	34	4.8	6.51	1.71	-4.88
F	32.81	33.15	22.47	-10.68	33	4.75	11.08	6.38	-4.35
M	31.49	32	18.99	-13.01	30	3.5	10.69	7.16	-5.82
A	28.12	19.89	21.05	1.76				0	1.76
M	28.38	19.2	21.27	2.07				0	2.07
J	24.39	19.12	19.84	0.72				0	0.72
J	28.24	19.09	21.49	2.34				0	2.34
A	28.34	19.09	21.89	2.8				0	2.8
S	28.71	19.12	21.41	2.29				0	2.29
O	28.57	22.32	23.08	0.76	22	0.16	0.01	-0.15	0.61
N	26.05	22.13	22.58	0.45	22	0.48	0.01	-0.47	-0.02
D	27.12	21.28	19.41	-2.87	21	0.39	1.81	1.22	-1.35
J92	28.02	21.8	18.23	-3.57	21	0.54	2.77	2.23	-1.34
F	22.86	21.81	19.78	-1.88	21	0.69	1.13	0.44	-1.39
M	20.65	21.42	18.69	-2.73	21	0.86	2.32	1.47	-1.26
A	23.10	19.84	20.44	0.6				0	0.6
M	28.44	19.91	21	1.09				0	1.09
J	28.02	19.89	22.91	2.82				0	2.82
J	28.42	19.84	21.28	1.44				0	1.44
A	28.82	19.77	21.05	1.28				0	1.28
S	27.69	19.72	21.93	2.21				0	2.21
O	27.19	21.83	22.3	0.47	21	0.03	0.01	-0.02	0.45
N	27.92	21.74	20.47	-1.27	21	0.19	0.57	0.38	-0.89
D	27.80	21.88	18.95	-2.4	21	0.35	1.73	1.38	-1.02
J93	26.89	21.50	18.75	-2.75	21	0.88	2.58	1.7	-1.05
F	24.05	21.44	20.16	-1.28	21	0.65	0.84	0.19	-1.07
M	25.10	21.22	20.89	-0.88	21	0.75	0.89	-0.16	-1.08
A	26.85	20.92	20.45	-0.06	20	0.01	0	-0.01	-0.07
M	28.96	20.7	20.44	-0.26	20	0.24	0.03	-0.21	-0.47
J	28.77	20.75	19.26	-1.48	20	0.35	0.74	0.41	-1.07
J	25.65	20.73	18.1	-2.69	20	0.48	2.11	1.68	-1.01
Totals				0.02				33.48	33.48

Month	Com Jet	JP5	WTI 1st
O86		16.49	14.88
N		17.04	16.84
D		14.88	15.15
J87		17.38	16.01
F		16.84	16.45
M		16.05	16.12
A		20.82	16.11
M		20.75	16.41
J		20.71	16.82
J		20.38	21.38
A		21.97	20.73
S		22.88	19.97
O		24.88	18.88
N		24.01	18.84
D		22.85	18.51
J88	23.88	23.10	16.75
F	23.1	21.28	17.13
M	22.88	19.88	16
A	22	21.81	17.89
M	22.24	21.84	17.48
J	22.13	22.10	16.73
J	21.18	20.07	14.78
A	20.5	20.98	15.71
S	20.21	16.88	14.48
O	19.85	16.02	13.8
N	20.08	16.08	12.88
D	21.88	22.80	16.08
J89	22.75	21.84	17.88
F	24.02	24.38	17.73
M	24.81	22.88	18.5
A	25.88	26.08	20.89
M	24.59	27.28	19.02
J	23.58	28.44	19.38
J	23.01	26.07	20.38
A	20.08	21.89	16.89
S	25.01	22.08	16.78
O	27.08	24.10	20.17
N	27.48	25.27	19.84
D	30.4	30.02	20.7
J90	28.88	28.45	22.9
F	25.24	28.00	22.08
M	27.12	27.02	20.24
A	26.02	28.38	17.88
M	24.82	24.24	19.02
J	23.24	22.89	16.82
J	23.14	27.85	16.94
A	28.85	26.01	26.25
S	30.08	34.42	31.3
O	40.20	41.84	38.89
N	45.88	40.38	31.87
D	39.32	40.88	29.9
J91	34.88	30.38	27.71
F	31.1	32.81	22.47
M	28.38	31.49	18.99
A	24.95	28.12	21.05
M	25.48	28.38	21.27
J	25.1	24.39	19.84
J	26.2	28.24	21.49
A	27.12	28.34	21.89
S	28.2	28.71	21.41
O	26.9	28.57	23.08
N	29.81	26.05	22.58
D	28.11	27.12	19.41
J92	22.81	28.02	18.23
F	23.88	22.86	19.78
M	23.22	20.65	18.69
A	24.25	23.10	20.44
M	25.14	28.44	21
J	27.02	28.02	22.51
J	27.81	28.42	21.28
A	27.03	28.82	21.05
S	27.49	27.69	21.93
O		27.19	22.3
N		27.92	20.47
D		27.00	18.95
J93		26.89	18.75
F		24.05	20.16
M		25.10	20.89
A		26.85	20.45
M		28.96	20.44
J		28.77	19.26
J		25.65	18.1
J88—S92			
Corrl Jet	1	0.885	0.947
Corrl WTI	0.947	0.848	1
O86—J93			
Corrl WTI	N/A	0.821	1

(DFSC & NYMEX data)

Selected JP-5 Utility Curve Computation Data

p(LP=20)	r(LP=20)	(1-p)	r(HP=30)	r=E(r)	b	U	E(U)	E(P)	AP(CP=25)
0	0.2	1	-0.2	-0.2	3	-0.32	-0.32	30	20
0.1	0.2	0.9	-0.2	-0.16	3	-0.2368	-0.28	29	21
0.2	0.2	0.8	-0.2	-0.12	3	-0.1632	-0.24	28	22
0.3	0.2	0.7	-0.2	-0.08	3	-0.0992	-0.2	27	23
0.4	0.2	0.6	-0.2	-0.04	3	-0.0448	-0.16	26	24
0.5	0.2	0.5	-0.2	0	3	0	-0.12	25	25
0.6	0.2	0.4	-0.2	0.04	3	0.0352	-0.08	24	26
0.7	0.2	0.3	-0.2	0.08	3	0.0608	-0.04	23	27
0.8	0.2	0.2	-0.2	0.12	3	0.0768	1.1E-17	22	28
0.9	0.2	0.1	-0.2	0.16	3	0.0832	0.04	21	29
1	0.2	0	-0.2	0.2	3	0.08	0.08	20	30

(DFSC data)

Selected WTI Utility Curve Computation Data

p(LP=16)	r(LP=16)	(1−p)	r(HP=24)	r=E(r)	b	U	E(U)	E(P)	AP(CP=20)
0	0.2	1	−0.2	−0.2	3	−0.32	−0.32	24	16
0.1	0.2	0.9	−0.2	−0.16	3	−0.2368	−0.28	23.2	16.8
0.2	0.2	0.8	−0.2	−0.12	3	−0.1632	−0.24	22.4	17.6
0.3	0.2	0.7	−0.2	−0.08	3	−0.0992	−0.2	21.6	18.4
0.4	0.2	0.6	−0.2	−0.04	3	−0.0448	−0.16	20.8	19.2
0.5	0.2	0.5	−0.2	0	3	0	−0.12	20	20
0.6	0.2	0.4	−0.2	0.04	3	0.0352	−0.08	19.2	20.8
0.7	0.2	0.3	−0.2	0.08	3	0.0608	−0.04	18.4	21.6
0.8	0.2	0.2	−0.2	0.12	3	0.0768	1.1E−17	17.6	22.4
0.9	0.2	0.1	−0.2	0.16	3	0.0832	0.04	16.8	23.2
1	0.2	0	−0.2	0.2	3	0.08	0.08	16	24

(NYMEX data)

INITIAL DISTRIBUTION LIST

1.	Defense Technical Information Center Cameron Station Alexandria, VA 22304-6145	2
2.	Superintendent Attn: Library Code 52 Naval Postgraduate School Monterey, CA 93943-5002	2
3.	Commander Attn: Codes DFSC-D, DC, P, N, G Defense Fuel Supply Center Cameron Station Alexandria, VA 22304-6160	2
4.	Commander Attn: RADM Leonard Vincent Defense Contract Management Command Cameron Station Alexandria, VA 22304	1
5.	Director Attn: RADM Edward M. Straw Defense Logistics Agency Cameron Station Alexandria, VA 22304	1
6.	Commander Attn: RADM Robert M. Moore Naval Supply Systems Command Washington, DC 20376-5000	1
7.	Director Defense Logistics Studies Information Exchange U.S. Army Logistics Management College Fort Lee, VA 23801-6043	1
8.	Superintendent Attn: Administrative Sciences Code AS/LT Naval Postgraduate School Monterey, CA 93943-50005	1

9. Superintendent 1
   Attn: Administrative Sciences Code AS/GT
   Naval Postgraduate School
   Monterey, CA 93943-50005

10. U.S. Department of Energy 1
    Office of Oil and Gas Policy
    Attn: Robert A. Speir
    1000 Independence Avenue, SW
    Washington, DC 20585

11. LT Brion S. Snyder 2
    47 Montsalas Dr.
    Monterey, CA 93940